Incident- light Photomicroscope III

Operating Instructions

G 41 - 656 - e

Sectional view of incident-light Photomicroscope III

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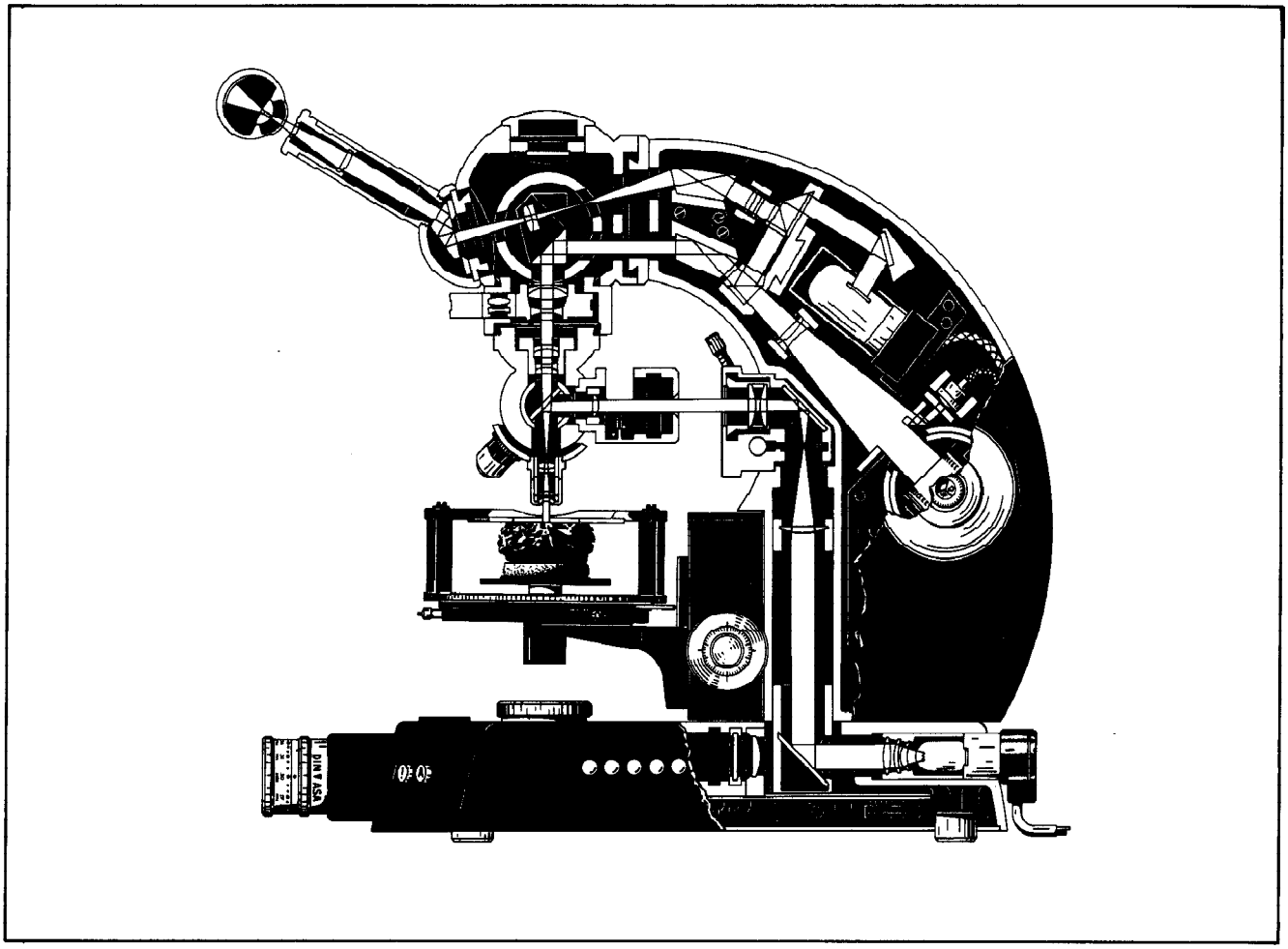


Notes

This manual deals exclusively with the use of Photomicroscope III in incident light. Its use in transmitted light, for fluorescence, photometry, polarizing microscopy, etc. is described in separate manuals which are listed at the end of this manual.

- The 6- to 10-digit numbers which you will find in these instructions, e.g. 47 30 12-9902, are ordering numbers of instruments or instrument components.

- Specifications subject to change.

Contents Page

Description of instrument 4
- Operating controls 4
- Assembly 8

Operation of instrument 12
- Preparatory work 12
- Brightfield 14
- Differential interference contrast 16
- Antiflex method 18
- Darkfield 23

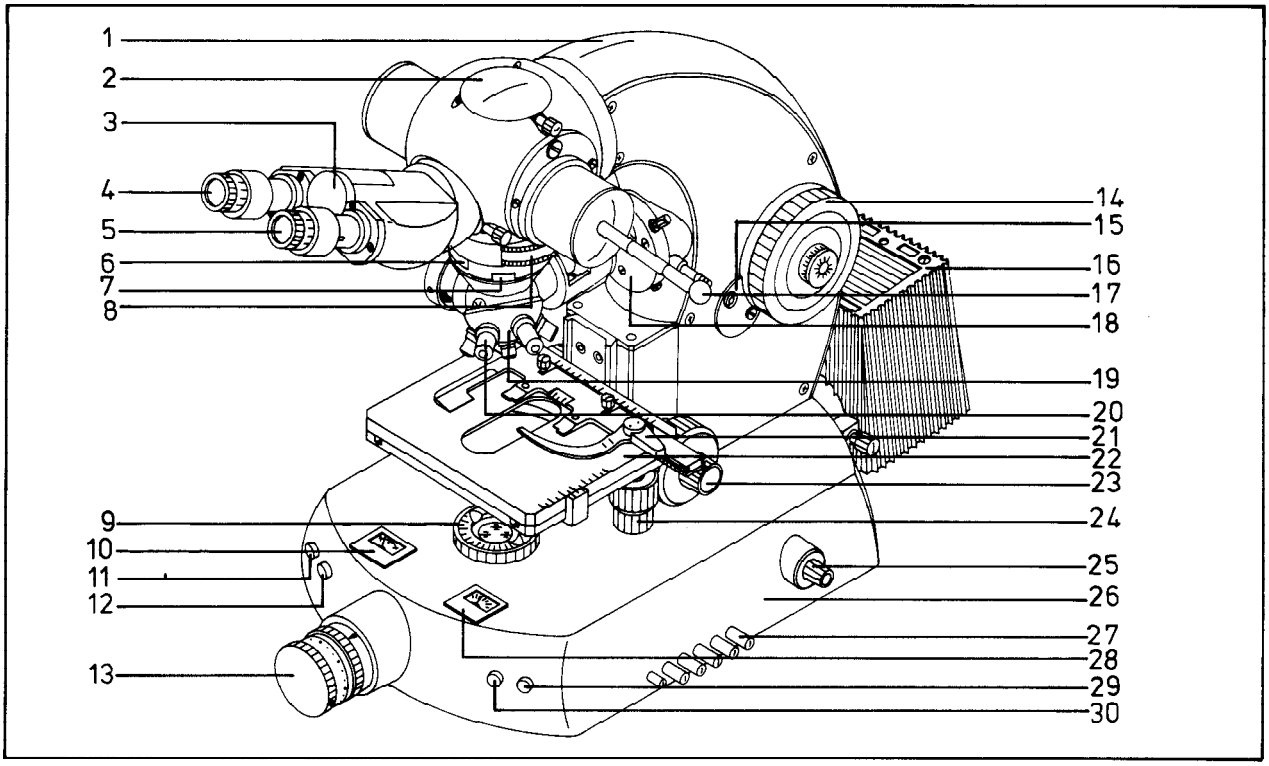
Camera 24
- Automatic photography 24
- Brief instructions for photography with automatic exposure control 27
- Microscope magnification and image scale 28
- Special applications 29
- Computer flash 30

Components and accessories 34
- Microscope illuminators 34
- Epi-condensers 36
- Reflectors 39
- Objectives 41
- Eyepieces 44
- Specimen stages 45

Description of instrument

Photomicroscope III, stand equipment 49 21 28

2



Operating controls

1 Stand

2 Port for attachment cameras or receivers such as TV camera or photometer attachment (close with lid when not in use)

3 Inclined binocular tube G (47 30 12-9902)

4 Wide-angle focusing eyepiece

5 Wide-angle focusing eyepiece

6 Fill plug in opening for analyzer slider

7 Slot for compensators and auxiliary objects

8 Optovar magnification changer with Bertrand lens; with the upper knurled ring you focus the objective exit pupil where an image is formed, for example, of light source or aperture diaphragm, with the lower knurled ring you set the magnification factor 1.25-1.6 or Ph (to observe the objective exit pupil)

9 Setting ring for luminous field diaphragm (for transmitted light only)

10 Voltmeter for illuminators connected to power supply (47 20 83) with scales 0-12 V and 0-6 V

11 Pushbutton B opens the shutter electrically; when released it closes the shutter

12 Pushbutton T opens the shutter; when pushed again and thus unlocked it closes the shutter

13 Film speed selector

14 Cassette with frame counter (47 20 26-9901)

15 Pin permitting multiple exposures when pushed in with a screwdriver

16 Illuminator 100

17 Pushrod with the following click stops:

white ring:	100 % light to the binocular tube
red ring:	20 % light to the binocular tube, 80 % upwards
black ring:	photography position; normally almost 50 % light for observation and almost 50 % for photography; less than 5 % for multiplier
colorless ring:	100 % light upwards, e.g. to a camera

18 Aperture diaphragm for incident light (47 20 75)

19 Epi-condenser

20 Objectives

21 Specimen holder 50 (47 34 48)

22 Mechanical stage, travelling range 50x75 mm, with graduation and low-mounted, right-hand coaxial control (47 34 15)

23 Coarse/fine focusing control

Note: before operating the focusing control remove the transport lock (plastic plate beneath the pinion box) by lifting the pinion box with the coarse focusing control

24 Coaxial controls for specimen movement in X and Y

25 ON-OFF switch for automatic photography and power switch with voltage control for illuminators connected to power supply (47 20 83)

26 Microscope base

27 Filter selector for transmitted light

Filters (pushbuttons from back to front):

Neutral density filter 0.03 (46 78 42)
Neutral density filter 0.12 (46 78 41)
Neutral density filter 0.5 (46 78 40)
Neutral density filter 0.5
Green filter VG 9 (46 78 05)
Blue conversion filter (46 78 50)
for photography on daylight film

If you want to use several filters at a time, push the corresponding buttons in simultaneously. The black push-button is the OFF-switch.

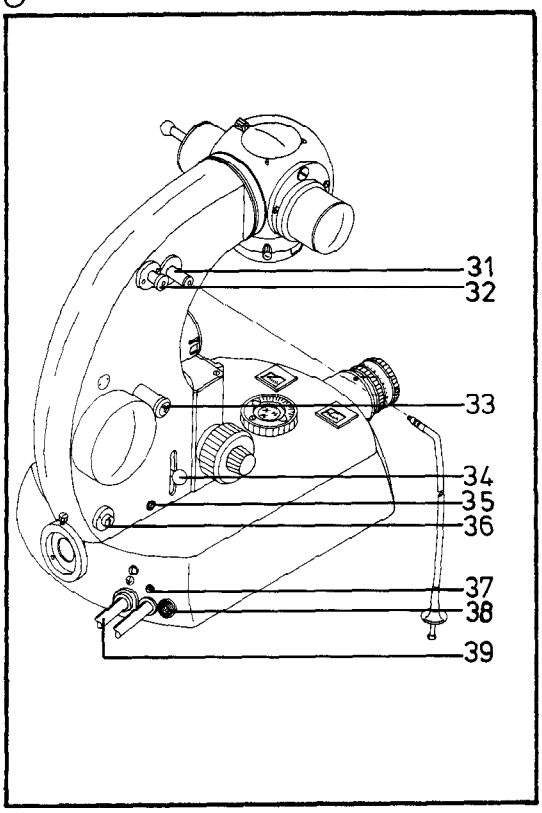
With the neutral density filters the transmittance can be graded at a ratio of 2:1. The transmittance of a filter combination is determined by multiplication; two neutral density filters, for example, have a transmittance of 0.5 x 0.5 = 0.25.

28 Brightness indicator for photograhy (see p. 34 ff)

29 Pushbutton A: camera shutter ready for photography

30 Pushbutton !: several functions (see p. 34 ff)

3



31 Receptacle for cable release. When working with cable release all the light is relayed to the film, which is important for images of low light intensity.

32 Selector for integrated or spot measurement

pushed in: the exposure time is determined automatically according to the mean brightness of 2/3 of the central image field

pulled out: the exposure time is determined automatically according to the illuminance within the circle in the center of the reticle visible in photography position

33 Control to adjust the flash duration to the film material and the type of its development

34 Knob for reflecting mirror

up: the light is relayed to the luminous field diaphragm for transillumination

down: the light leaves the opening of the aperture diaphragm insert for incident illumination

35 Terminal for flash lead of flash generator

36 Flash ready signal (see also p. 30)

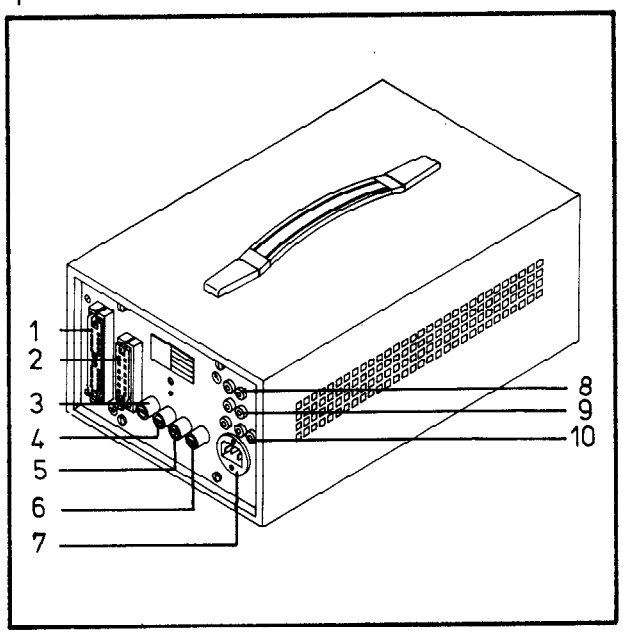
37 Terminal for connection of light sensor to flash generator

38 Socket for pedal switch or pulse generator for remote control

39 Electrical connections to power supply (47 20 83)

Power supply (2/3 rack 19") 47 20 83

4



1 22-pole socket for the supply voltages of the automatic exposure control

2 12-pole socket for the mains-voltage lines to the microscope

3 Fuse 1: secondary

4 Fuse 2: secondary

5 Fuse 3: primary

6 Fuse 4: primary

7 Mains socket

8 Socket for external measuring instrument, 6 V rated voltage, or 6 V max. 50 W filament lamp

9 Socket for 6 V max. 50 W filament lamp

10 Socket for 12 V max. 100 W filament lamp for plugs with 13 mm or 16 mm pin spacing

The following lamps can be connected:

One 12 V 100 W, or
One 12 V 60 W plus one 6 V 15 W, or
One 12 V 30 W plus two 6 V 15 W, or
Two 6 V 15 W

When connected to the mains, the power supply is switched on with the power switch on the right side of the microscope base, which is also voltage control. The adjusted lamp voltage is indicated on the voltmeter to the left of the microscope base.

Technical data

Mains voltage		100-110-115-127-220-240 V	
Frequency		50-60 Hz	
Power consumption		190 VA	
Filament lamp supply		variable with potentiometer 12 V rated: ca. 4 ... 14 V 6 V rated: ca. 2 ... 7 V	
Fusing	S 1	M 1.6 E DIN 41 571	38 00 11 9650
	S 2	M 1.6 E DIN 41 571	38 00 11 9650
220-240 V	S 3	M 4 E DIN 41 571	38 00 11 9780
	S 4	M 4 E DIN 41 571	38 00 11 9780
100-127 V	S 3	M 6.3 E DIN 41 571	38 00 12 4390
	S 4	M 6.3 E DIN 41 571	38 00 12 4390
Weight	ca. 9 kg		
Dimensions	length: 380 mm, width: 240 mm, height: 150 mm		

Assembly

General information

Because of the many possible configurations of the modular system, only the assembly of some components is described here.

Other components (see also p. 34 ff) are assembled in the same manner.

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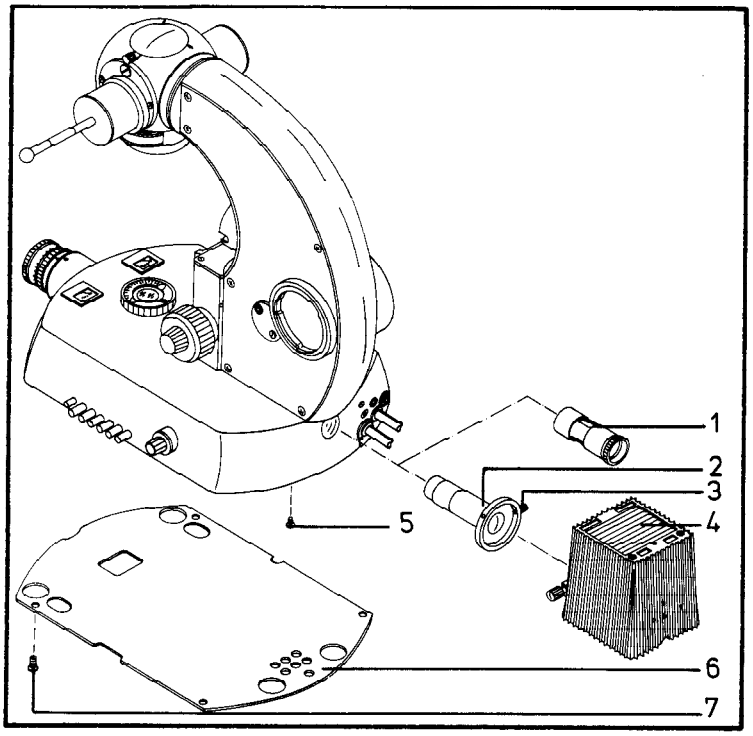

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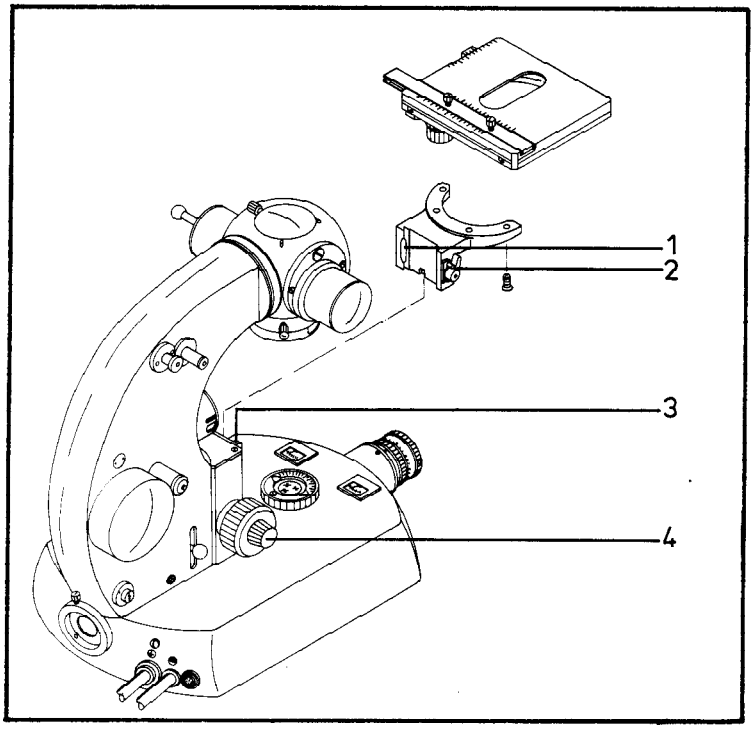

Mounting illuminator 100

- Loosen screw (3) of mounted tube (46 70 40-9903) (2), with the dovetails of the slightly tilted illuminator (4) press down the spring holt and fit the dovetails.
- Tighten screw (3)
- The power switch on the right side of the microscope base must be OFF; connect illuminator 100 with power supply

  To mount illuminator 100 on a microscope with 6 V 15 W low-voltage illuminator, proceed as follows:
- Loosen four screws (7) and remove cover sheet (6)
- Loosen screw (5) and take out tube (1)
- Slide in tube (2) and secure with screw (5)
- Secure cover sheet (6) with screws (7)

Mounting specimen stage on attachable stage carrier on change slide

- Rack down change slide (3) with coarse focusing control (4)
- Flick up lever (2) and place right guide rail (1) against change slide; let the left side snap in, slide it down as far as it will go and flick down lever.

If stage carrier and stage are supplied separately they must be assembled following the instructions on p. 45 hereof.

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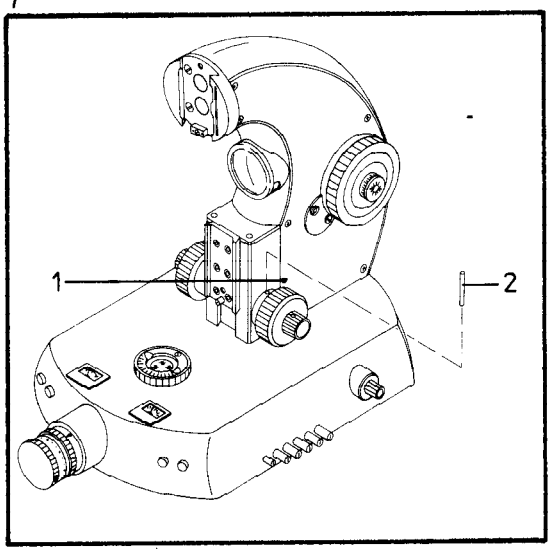

Correct adjustment of coarse/fine focusing control

The coarse/fine focusing control acts on the specimen stage. The motion of the coarse focusing control can be adjusted by plugging the supplied metal pin (2) into the borehole and moving it in the direction of the arrow to stiffen the motion. Set the fine focusing to a medium working range by turning the control until dot (1) is bracketed by the two lines. Then focus on the specimen by operating the control; the fine focusing will have enough play in either direction.
One interval of the graduation corresponds to a vertical movement of the stage of 2 μm = 0.002 mm.

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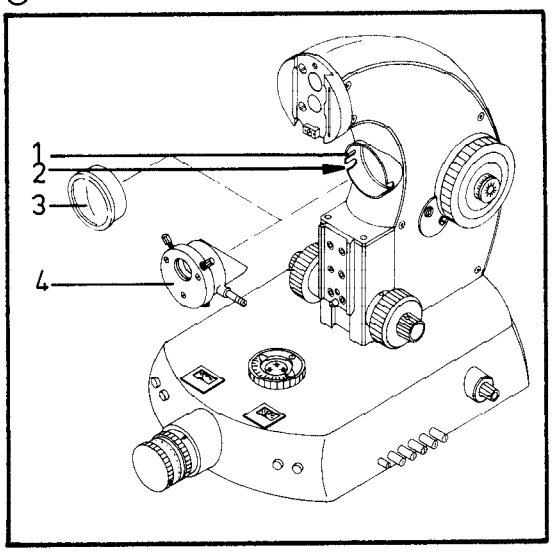

Fitting the aperture diaphragm for Photomicroscope

- Remove lid (3)
- Slide aperture diaphragm (4) in as far as it will go; the correct position is given by recess (1).
- Tighten screw (2)

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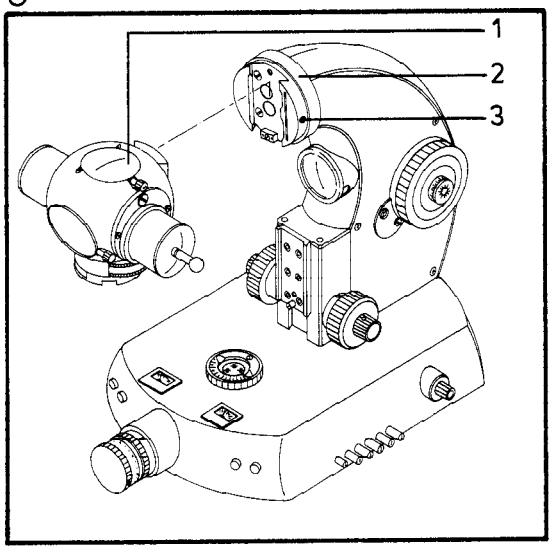

Mounting the tube head

- Loosen clamping screw of flat ring (2) and slide ring back
- Place slide of tube head (1) on top of guides of stand, slide it down as far as it will go and secure it with clamping screw (3). Pull ring (2) back and secure with screw to the left.

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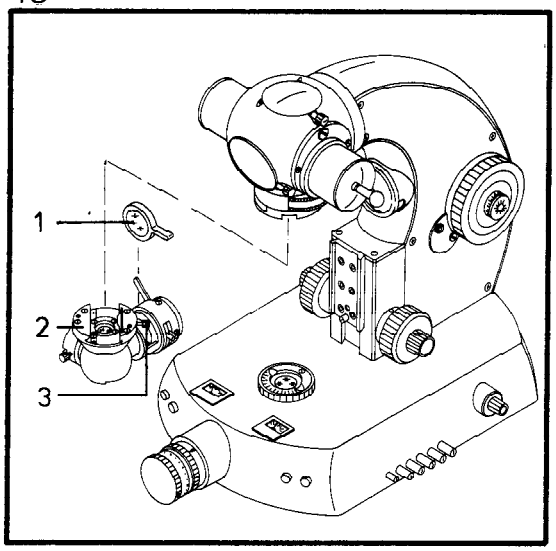

Mounting the epi-condenser

- Attach epi-condenser (2) to the change slide, slide it in as far as it will go and secure with knurled screw (3).
- Insert a filter (1) in the filter holder, if necessary.

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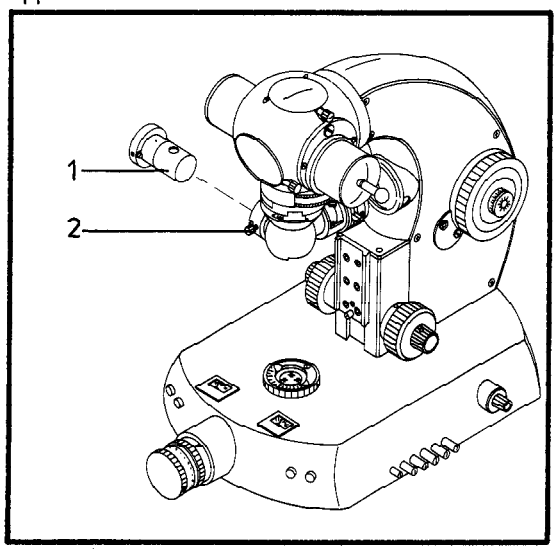

Inserting the reflector

- Slide reflector (1) into epi-condenser and secure with clamping screw (2).
- The guiding pin must engage the notch. (Not necessary with epi-condenser III D which has a rigidly mounted reflector).

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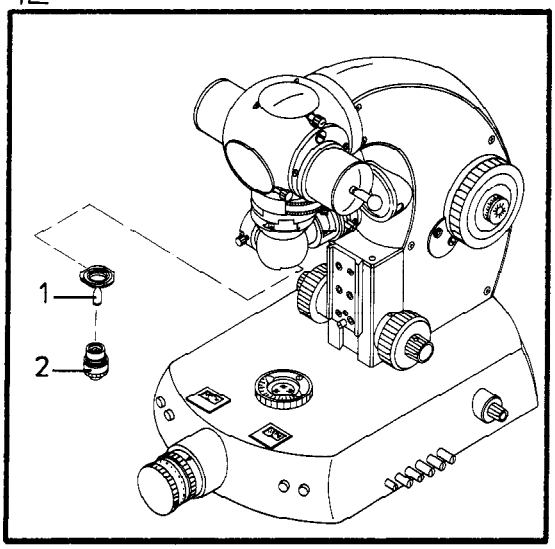
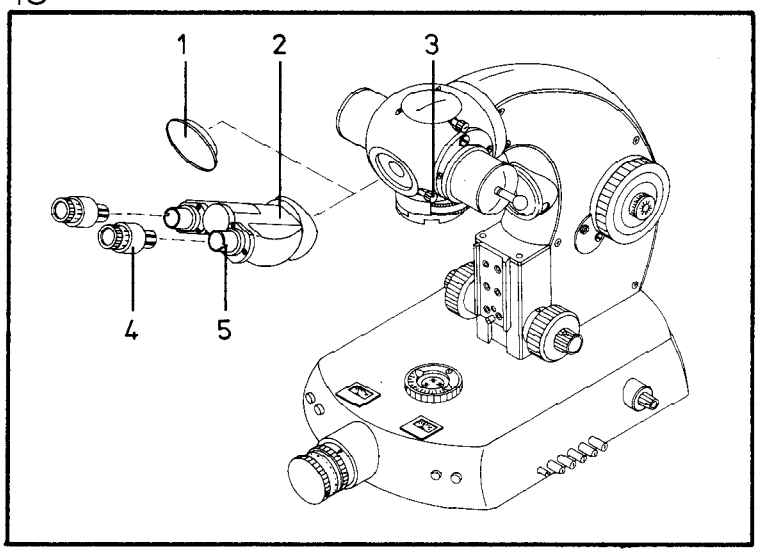


Fitting the objectives

- Epi-condenser with quick changer for single objectives (II C): from the side slide change ring (1) with objective (2) into the dovetails and turn it backwards as far as it will go.
- Screw objective into epi-condenser with quadruple nosepiece.

13



Mounting the inclined tube, fitting the eyepieces

- Unscrew clamping screw (3) and remove lid (1)
- Press down spring bolt of clamping screw (3) with dovetails (2) of inclined tube.
- Mount inclined tube on tube head and hold it until it is secured with clamping screw (3)
- Plug eyepieces (4) into tubes; they must engage notch (5).

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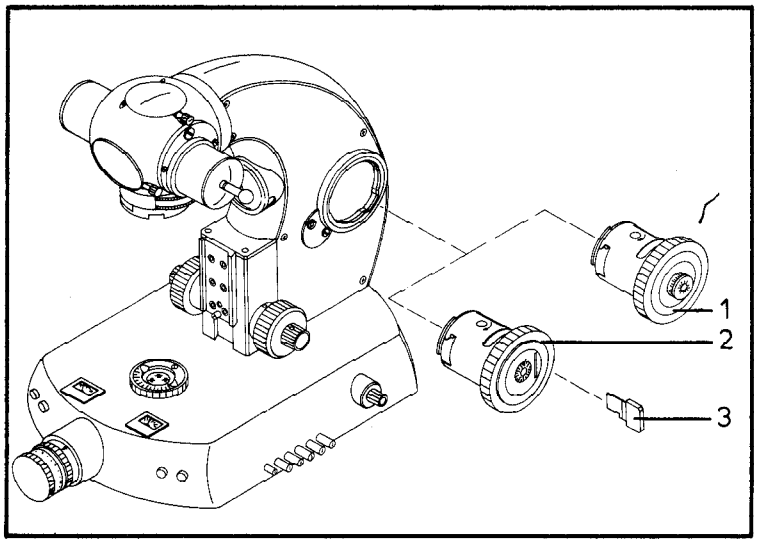

Mounting the film cassette

- Load the cassette with film (see also p. 24 ff), and attach cassette with frame counter (1) (47 20 26-9901) so that the red line is opposite the red dot. Push in the cassette and lock it by turning it clockwise.
- When using the loaded film cassette with negative identification (2) (47 20 27-9901) slider (3) with or without identification data must always be inserted in the slot.

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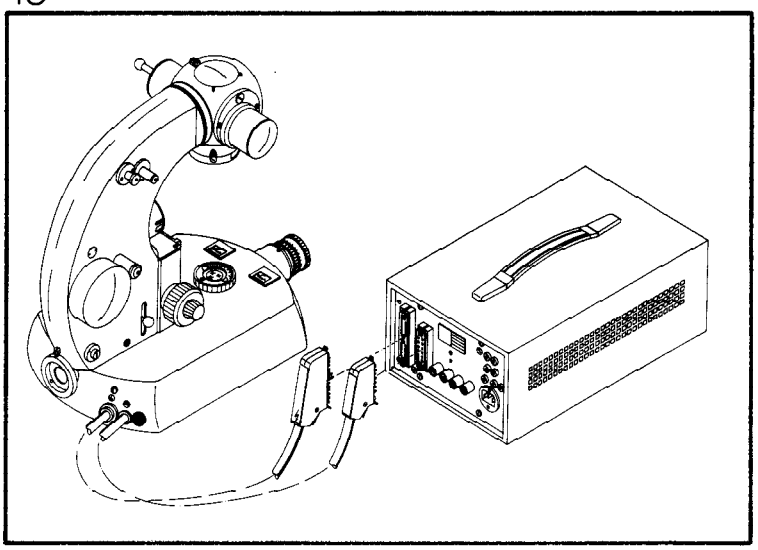

Connecting the microscope with the power supply

- On the power supply hook the plugs in on top and push them in at the bottom.

Operation of instrument

Preparatory work

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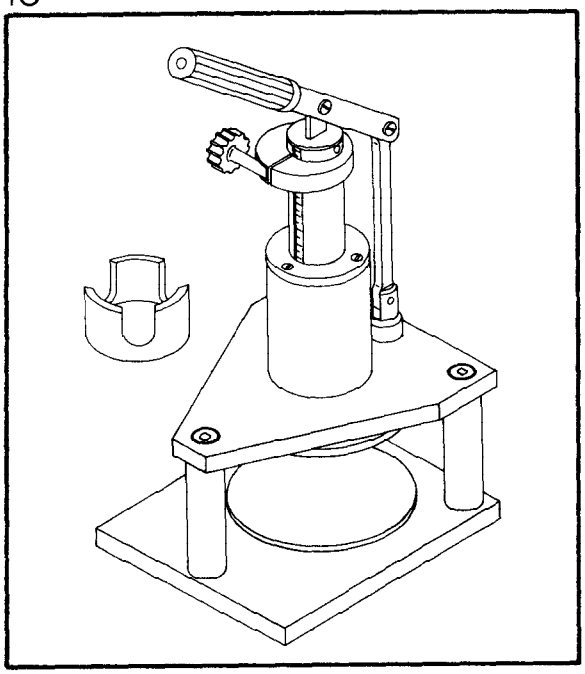


Levelling the specimen

Fill modeling material into jar and press the specimen into the material with the levelling press with lever (47 89 62). The jar with an outside diameter of 60 mm serves as specimen slide.

The above preparation is not necessary when you use the levelling stage. Once the polihed specimen is fixed beneath the microscope stage surface proper the polished surface is automatically aligned perpendicular to the microscope axis.

Remember for the use of the lamps

The power switch on the right side of the microscope base must be OFF before connecting the power supply (47 20 83) to the mains. The mains voltage indicated on the dial must comply with the local mains voltage. If this is not the case, call the maintenance service.

The lamps can generally be operated at undervoltage, which increases their life. Short-term operation at overvoltage is allowed, but remember that halogen lamps are immediately destroyed when run at overvoltage.
The voltage is indicated on the voltmeter to the left of the microscope base.

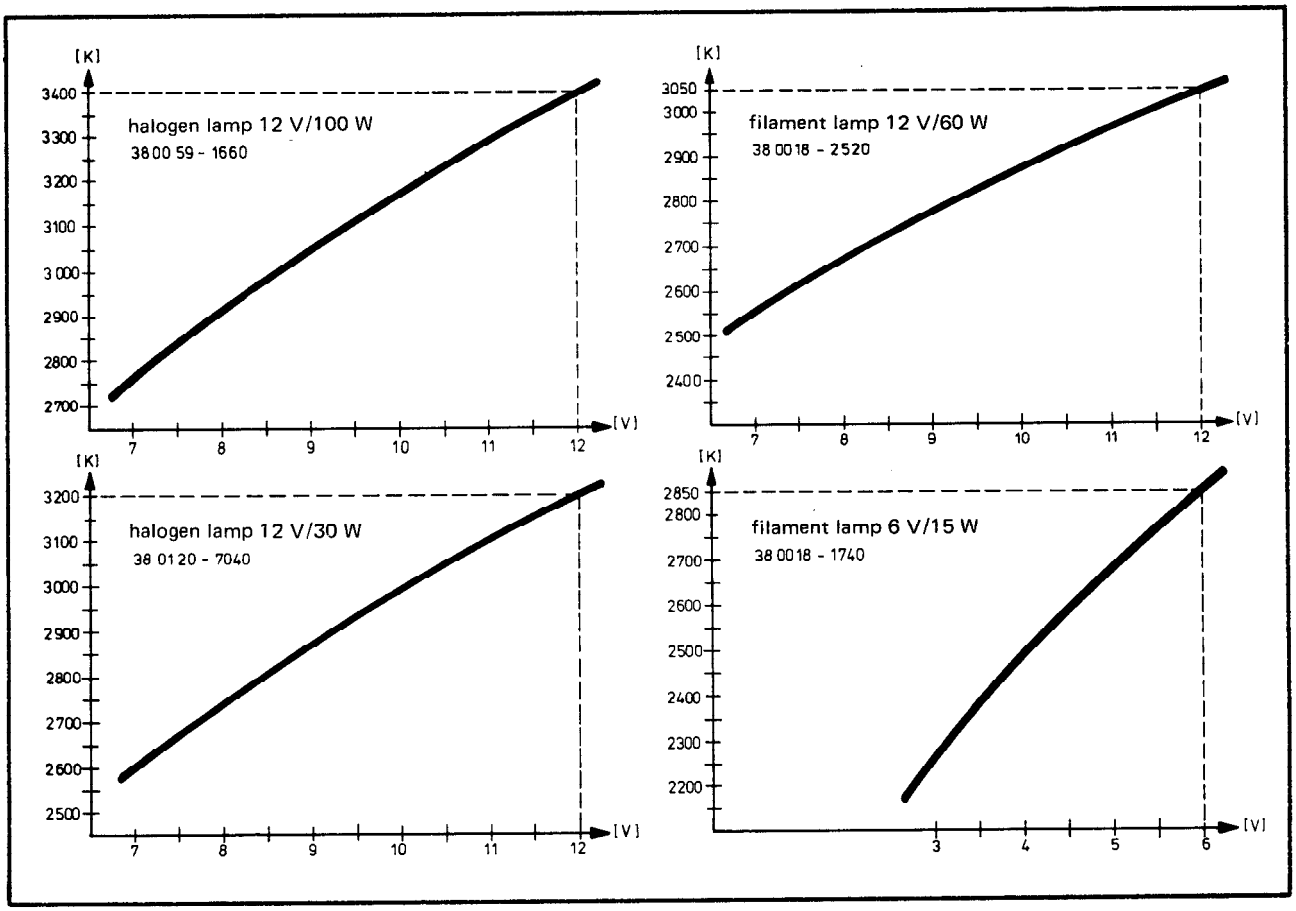
The correct light filter and the correct lamp voltage adjustment are important for **photography** with the microscope.

Green filter VG 9 (46 78 05) is generally used for **black-and-white** film. Like all other filters it is plugged into holding ring (46 72 52) and put into the filter holder of the epi-condenser.

It is recommended to run the lamp at 6 V 12 V rated voltage for **color photography**. Do not use conversion filters for artificial-light film, but blue conversion filter CB 12 (46 78 50) for daylight film.

Excellent results can be achieved in color photography if a certain color temperature is set by varying the lamp voltage, and this color temperature is then adjusted to the color temperature of the film with the aid of a conversion filter. Slight variations of the color temperature due to the optical system of the microscope cannot be considered. The four diagrams on the opposite page show the color temperatures of 6 V 15 W and 12 V 60 W filament and 12 V 30 W and 12 V 100 W halogen lamps as a function of the lamp voltage. The next table lists the color temperatures which must be set to arrive at the color temperature of the film with the indicated filters.

The four diagrams below show the color temperature as a function of the lamp voltage



Adjustment of light source to a color temperature of	Filter	Change of color temperature to
3100 K 2825 K 2400 K	CB 3 (46 78 52) CB 6 (46 78 51) CB 12 (46 78 50)	3400 K (artificial-light film)
2925 K 2700 K 2300 K	CB 3 CB 6 CB 12	3200 K (artificial-light film)
3300 K 3000 K 2750 K	CB 12 CB 15 CB 18	5500 K (daylight film)

CB 15 is a combination of a CB 12 and a CB 3 filter, CB 18 that of a CB 12 and a CB 6 filter.

Centering the light source

see the operating instructions of the illuminator.

Brightfield

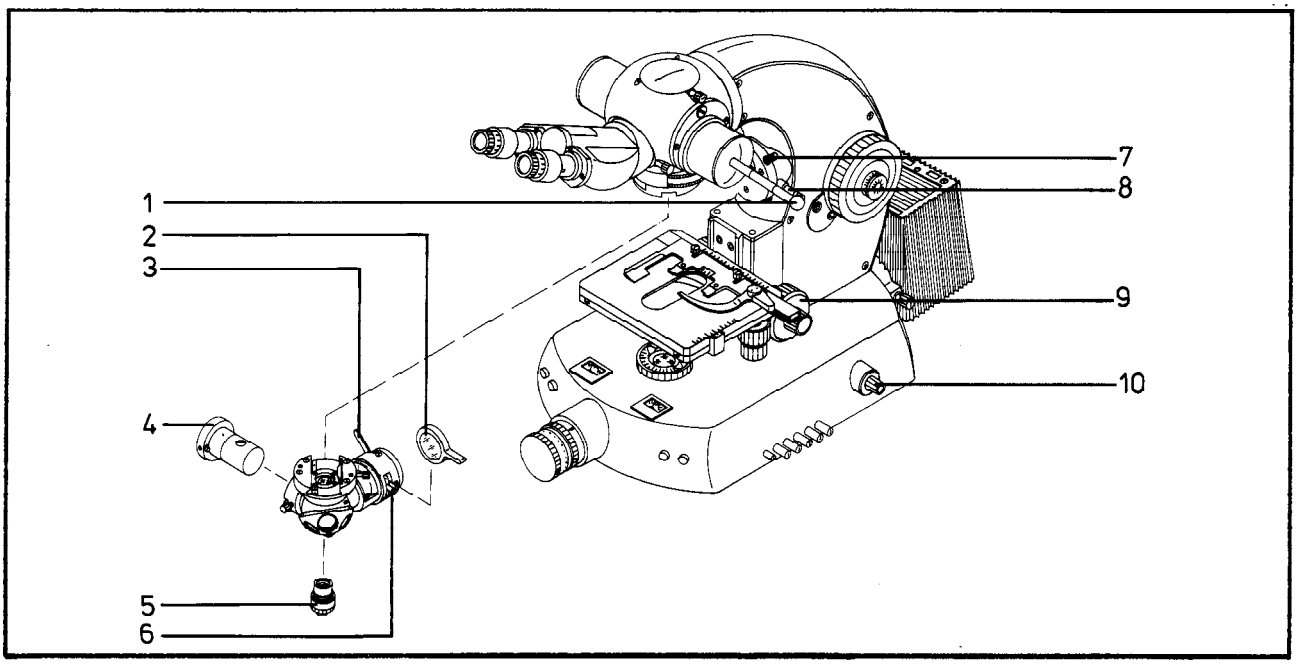
General information

Specimens which show sufficient contrast for differentiation or which have been specially prepared by etching or coating so that their structures become visible are examined in incident-light brightfield.

Adjusting the microscope

- Mount condenser
- Equip epi-condenser (only models II C and III C) with reflector (4) H-Pl, H-Pl Pol or H-Pr Pol
- Mount a low-power objective (5) on the epi-condenser
- Power switch (10) OFF; connect microscope illuminator to power supply and power supply to the mains
- Power switch ON; set lamp to rated voltage (indicated on voltmeter on microscope base) (For color photography see pp. 12/13 for lamp voltage and conversion filter)
- Set Optovar to the factor 1.25
- Hinge down reflecting mirror so that the light leaves the exit at the incident-light aperture diaphragm
- Set pushrod (1) to black ring for photography
- Turn in the focusing eyelenses of both eyepieces until the diagonal double crosslines of the reticle are in focus
- Push pushrod in
- Adjust both tubes until you see a circular sharply defined image
- Focus on the specimen with coarse/fine focusing control (9)
- Adjust illumination with neutral density filters (2)

17



18

With lever (3) open luminous field diaphragm of condenser II C or III C until the edge of its image appears in the field of view. In incident light it is always almost in focus in the object plane.

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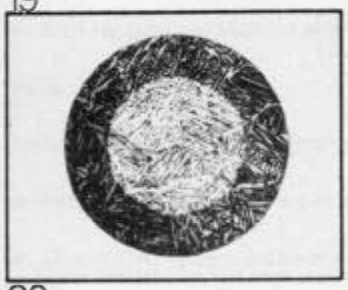


With the two levers (6) center the image of the luminous field diaphragm in the field of view.

20

Open the diaphragm until the entire field of view is illuminated.

21

Center aperture diaphragm with respect to the objective aperture (pupil). Set Optovar to Ph and with the upper knurled ring focus on the aperture diaphragm image in the objective aperture.

With H-PI and H-PI Pol reflectors the diaphragm image should lie in the center of the objective aperture, with the H-Pr Pol reflector within the free half of the objective aperture. The aperture diaphragm image should generally cover 2/3 to 4/5 of the objective aperture.

With the centering screws (7) and lever (8) adjust position and size of the aperture diaphragm image as shown by the opposite picture.

- Center lamp coil in the pupil (for the procedure see the operating instructions of the microscope illuminators).
- Set Optovar again to 1.25 for observation and adjust the illuminating aperture (8) to resolution and contrast of the specimen.
- Vary the brightness of the image with neutral density filters but never with the aperture diaphragm. Only the aperture-diaphragm size must be re-adjusted after objective change.

Differential interference contrast (DIC)

General information

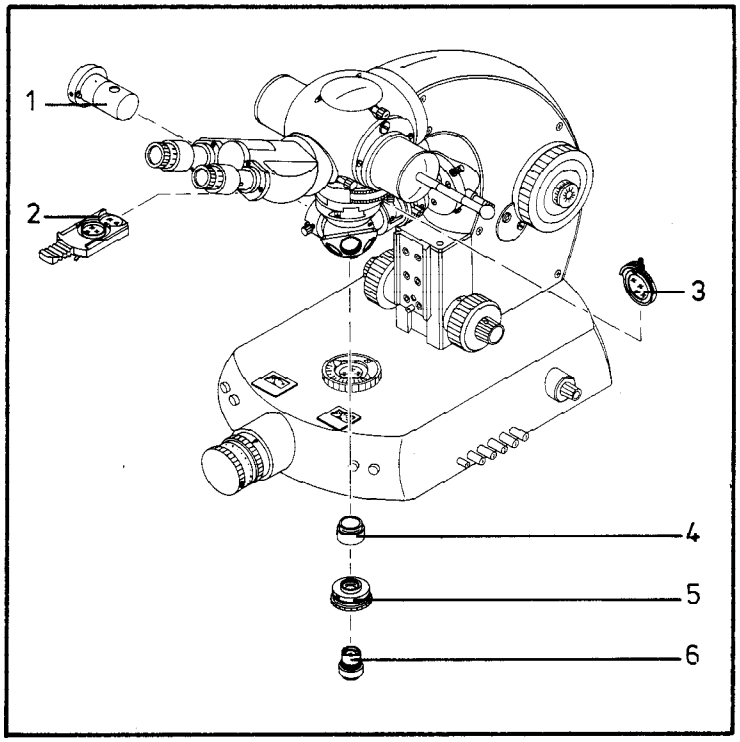
With a Nomarski DIC system minor differences in height, e.g. at grain boundaries, or minute "roughness" of polished surfaces or specularly reflecting objects are revealed in the form of a relief.

For the application of the method the following items are required in addition:

Polarizer (3)	47 36 16-9901
Analyzer (2)	47 36 63-9901
H-PI Pol brightfield reflector (1)	46 62 65
Change or adapter rings (4) to mount the DIC system on the condenser	
Epiplan Pol (6) and LD Epiplan Pol objectives	
One DIC system (5) for each objective	
Rotary specimen stage (recommended)	

For the choice of DIC systems and objectives and the way they are mounted on condensers (change or adapter rings) see p. 41 ff. Only two DIC systems can be fitted in opposite openings of condensers with exchangeable nosepieces.

22



Operation

- Screw Epiplan Pol objective (6) into DIC system (5) and mount both in change or adapter ring (4).
- Mount the entire unit on the condenser.
- Insert brightfield reflector (1). We recommend to use instead of an H-PI reflector an H-PI Pol reflector because it has no depolarizing effect.
- Put polarizer (3) into filter holder (position 0°, oscillation direction East-West) and analyzer (2) into tube head (oscillation direction North-South).
- Place specimen on stage and adjust Köhler illumination of the microscope (see p. 15).
- The contrast can be varied by turning the knurled ring (2, Fig. 23) of the DIC system. A gray hue of the background is recommended.

Only when you use a DIC system for the first time check the orientation of the oscillation directions of polarizer and analyzer in the following manner and correct them, if necessary.

- Remove objective and DIC system; place a specimen with specularly reflecting surface on the stage and illuminate by way of a plane-glass reflector, open diaphragms.
- Look through the "empty" tube (without eyepiece) when polarizer and analyzer are in the beam path. Through the empty tube you will see the opening dark or covered by dark, vertical fringes.
- Slightly turn polarizer or analyzer until you have achieved maximum extinction.

Note

Unless the DIC system is supplied fixed to change ring or nosepiece, align it with respect to the polarizer as follows:

- Polarizer and analyzer are in the beam path
- Mount DIC system without objective on epi-condenser and observe the same specimen through the empty tube.
- Set the knurled ring (2) of the DIC system half way between the two stops.
  Besides colored (3) you will also see a black interference fringe (zero fringe) (4).
  The zero fringe should be diagonally centered. If not, proceed as follows:
- Loosen the three screws (1) of the DIC system and turn its housing until the zero fringe is correctly positioned; make sure that the housing is not lowered.
- Tighten the three screws (1).

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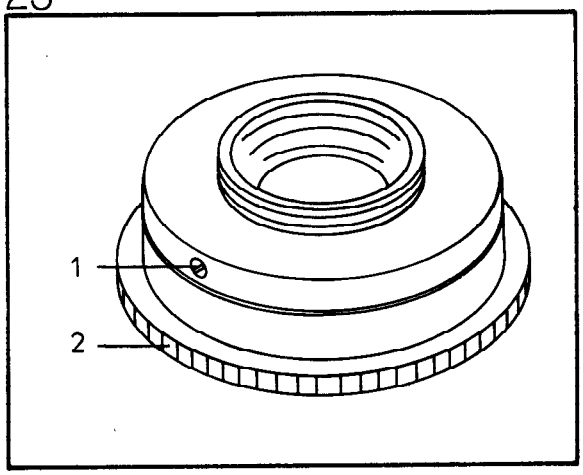

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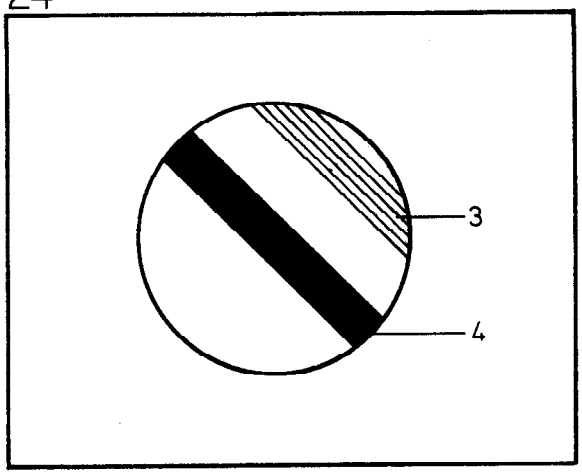
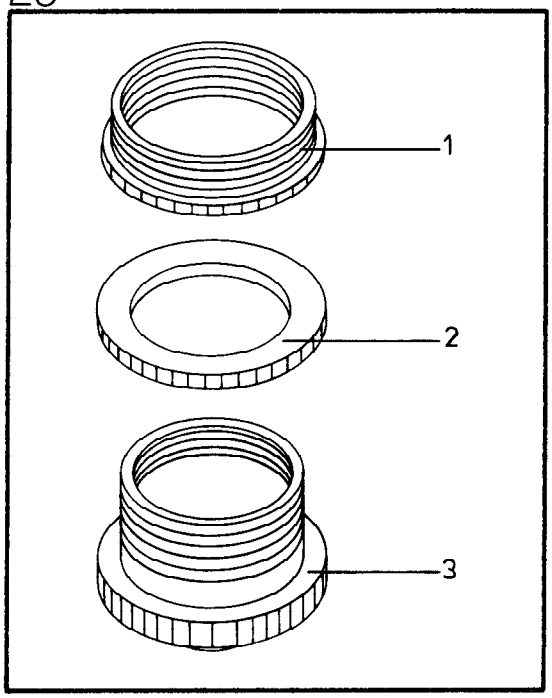


Antiflex method

General information

With the Antiflex method the image contrast of specularly and diffusely reflecting objects of particularly low reflectivity is enhanced in incident-light brightfield illumination. The method is applied to such objects as polished coal or ceramic specimens or rough surfaces of any type of solid body. The Antiflex system is a cap which is screwed to the objective.

25



1 Tube with external thread and seating surface which is screwed into the internal thread of the objective as far as it will go.

2 Counterring to secure the Antiflex cap after adjustment of height and oscillation direction.

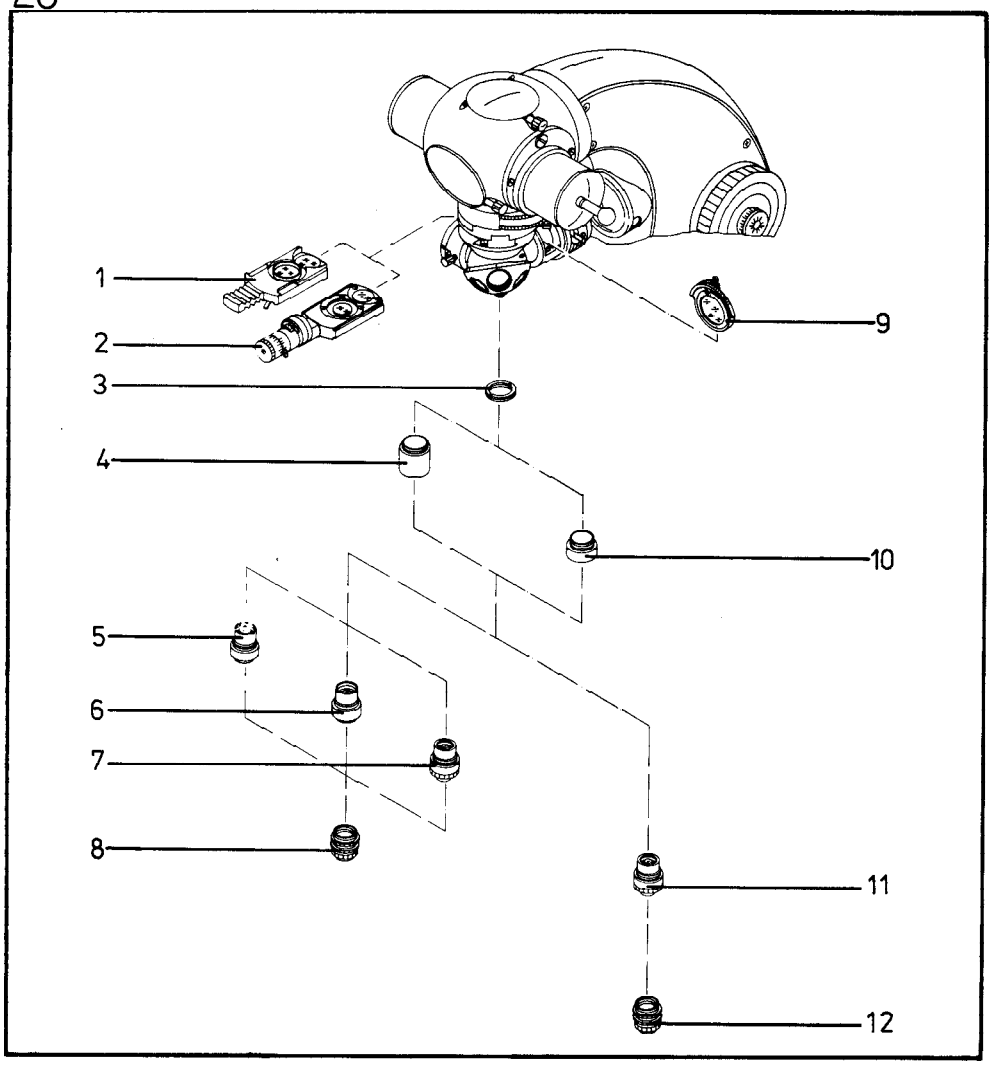
3 Antiflex cap with Antiflex plate. The cap is vertically adjustable so that the plate can be brought to 0.5 mm above the object and aligned so that its principal oscillation direction is diagonal to those of crossed polarizer and analyzer which ensures maximum brightness of the image.

Accessories for condensers III C of 45 mm and 33 mm parfocal lengths

		Cat.No.
1	Fixed analyzer, or, alternatively	47 36 63-9901
2	Rotary analyzer	47 36 62
3	Ring W 0.8/M 24	46 29 96
4	Spacer ring for 45 mm parfocal length	46 29 88
5	Epiplan 4/0.10 Pol objective	46 21 01
6	Epiplan 8/0.20 Pol objective	46 21 02
7	LD Epiplan 16/0.30 Pol objective	46 21 23
8	Antiflex cap oil for Epiplan 4-8 Pol and LD Epiplan 16 Pol objectives	46 29 25
9	Polarizer	47 36 16
10	Spacer ring for 33 mm parfocal length	46 29 99
11	LD-Epiplan 40/0.60 Pol objective	46 21 24-9901
12	Antiflex cap oil for Epiplan 40 Pol objective	46 29 26

Note
Spacer ring (4) instead of (10) is required for the condenser III C of 45 mm parfocal length. All other accessories are the same for both condensers.

26



Accessories for condenser II C

		Cat.No.
1	Fixed analyzer, or, alternatively	47 36 63-9901
2	Rotary analyzer	47 36 62
3	Epiplan 4/0.10 Pol objective	46 21 01
4	Epiplan 8/0.20 Pol objective	46 21 02
5	LD Epiplan 16/0.30 Pol objective	46 21 23
6	Antiflex cap oil for Epiplan 4-8 Pol and LD Epiplan 16 Pol objectives	46 29 25
7	Polarizer	47 36 16
8	Centering change ring W 0.8	46 62 56
9	LD Epiplan 40/0.60 Pol objective	46 21 24-9901
10	Antiflex cap oil for Epiplan 40 Pol objective	46 29 26

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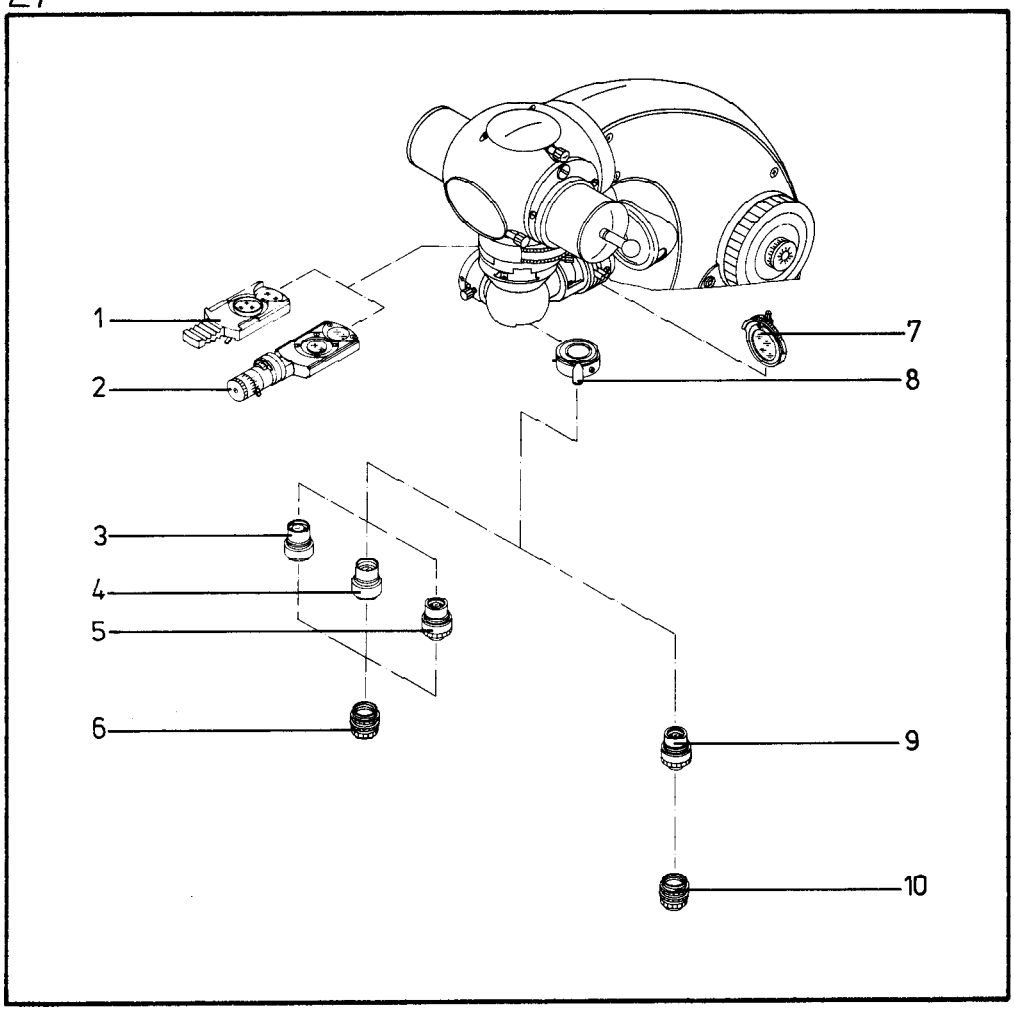
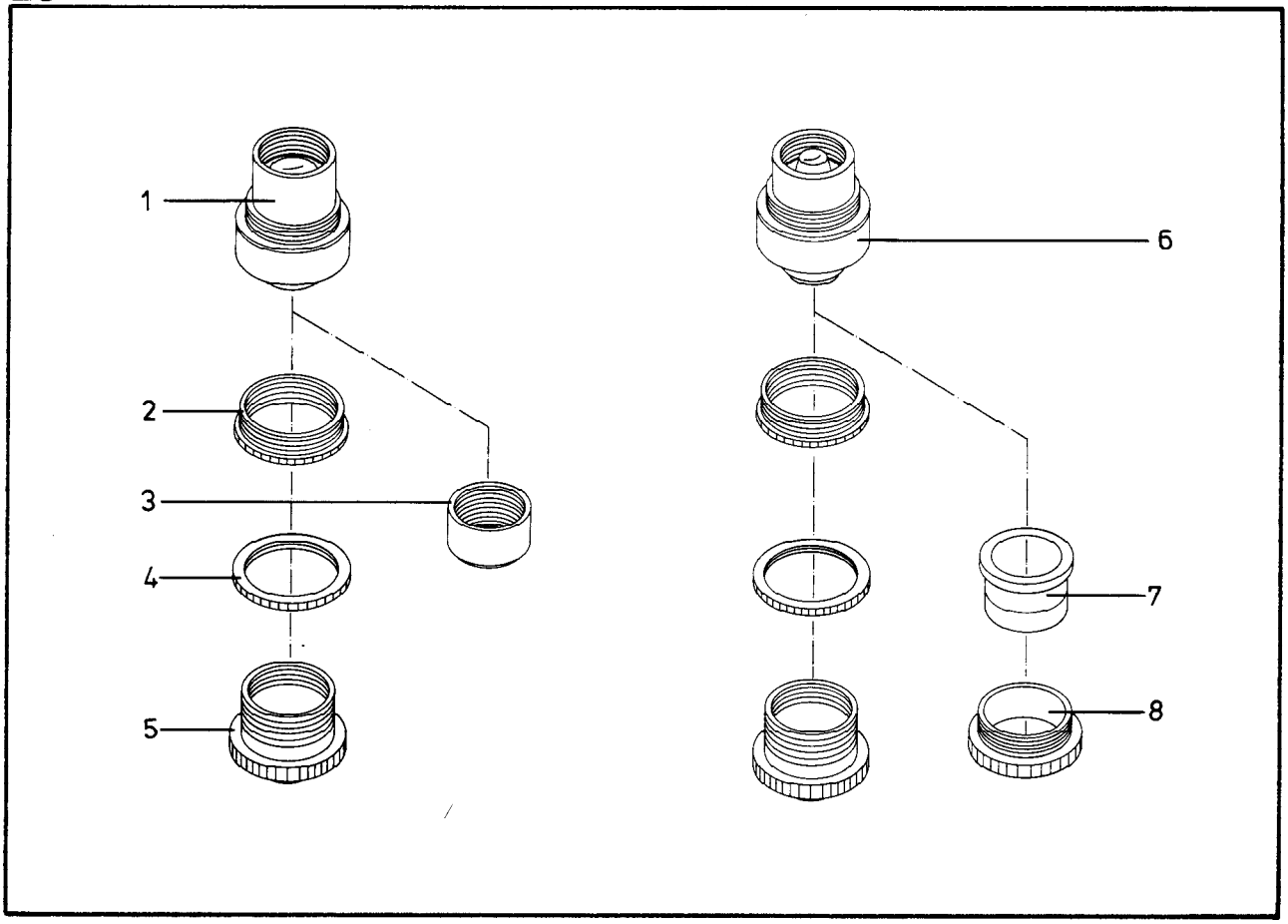


Mounting the Antiflex system on the objective

- Unscrew chromium-plated cap (3) from 4x and 8x objectives (1)
- Unscrew ring (8) and remove cap (7) from 16x and 40x objectives (6)
- Screw counterring (4) onto Antiflex cap (5) as far as possible towards the crystal plate.
- Screw tube (2) into internal thread of objective as far as it will go.
- Screw Antiflex cap (5) with counterring (4) into tube (2) until the counterring is in touch with the seating surface in the tube.

28

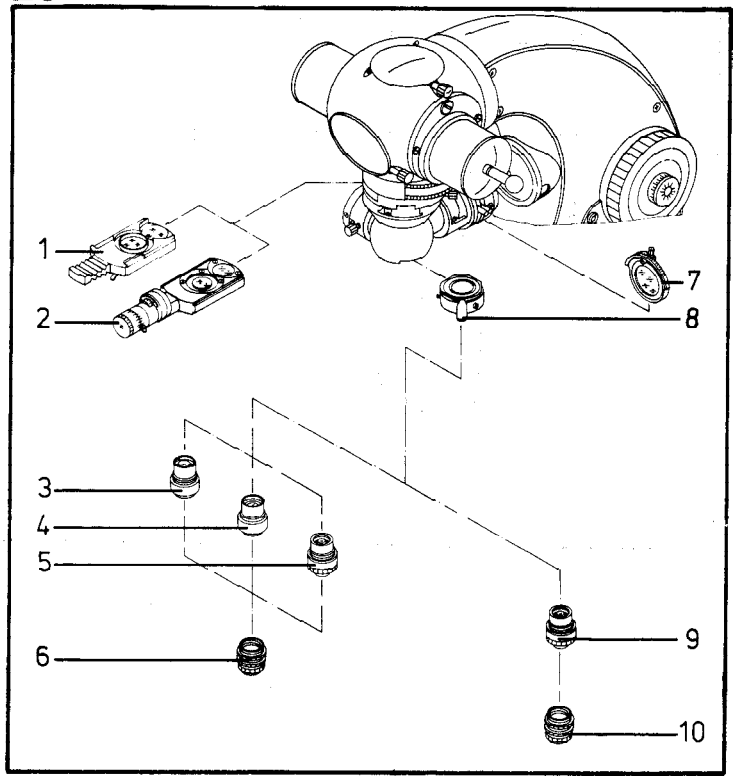


Adjusting the Antiflex image

Note: the adjustment is described for the condenser II C. The accessories listed on p. 19 are required for condenser III C of different parfocal length.

- Mount Antiflex caps (6, 10) on objective (3, 4, 5, 9) (see p. 21).
- Screw objective into centering change ring (8) and fit change ring in the condenser. Secure the change ring in the condenser by a counterclockwise turn.
- Put polarizer for incident light (7) into filter holder of epi-condenser; position zero.
- Slide in analyzer (1) or (2). Set rotary analyzer to 0°.
- Exactly cross analyzer and polarizer (see also under DIC on p. 17).
- Swing out analyzer.
- Immerse a stage micrometer or the specimen.
- Focus on a prominent feature.
- If in focused state there is no contact between Antiflex plate and immersion oil, unscrew the cap with Antiflex plate carefully from the tube until it immerses.
- Focus the image with the coarse/fine focusing control.
- Unscrew Antiflex cap until the image is in focus (ca. 0.5 mm above specimen surface).
- Swing in analyzer
- Turn the ring of the Antiflex cap; the image besomes brighter or darker. Fix the Antiflex cap when the image is brightest. To achieve this, turn the cap through not more than 45°.
- Hold Antiflex cap and screw counterring towards the bottom of the tube's seating surface, which secures the position of the Antiflex cap in the tube. If the tube with the fixed Antiflex cap is unscrewed from the objective it need not be re-adjusted when screwed again to the same objective. Check and, if necessary, correct the adjustment when screwing the Antiflex system to another objective.

29



Darkfield

General information

Darkfield illumination is particularly suitable to image diffusely scattering structures, such as fissures, pores or grain boundaries on dark background, or to differentiate transparent objects by way of "internal reflections".

Adjustment

Equip condenser II C or III C with darkfield reflector D, mount Epiplan HD objective and focus on the specimen.

In darkfield illumination luminous field and aperture diaphragms remain completely open.

Darkfield illumination can also be achieved with the incident-light HD system (46 62 63), which consists of an HD reflector (brightfield plane-glass reflector with darkfield ring mirror) and swing-out opaque stop. The latter is fixed with two screws at the outer rim of the filter holder of the epi-condenser which lies next to the reflector.
With this system you change quickly and easily between brightfield and darkfield illumination. You need not exchange the reflector but only swing the opaque stop in and out.

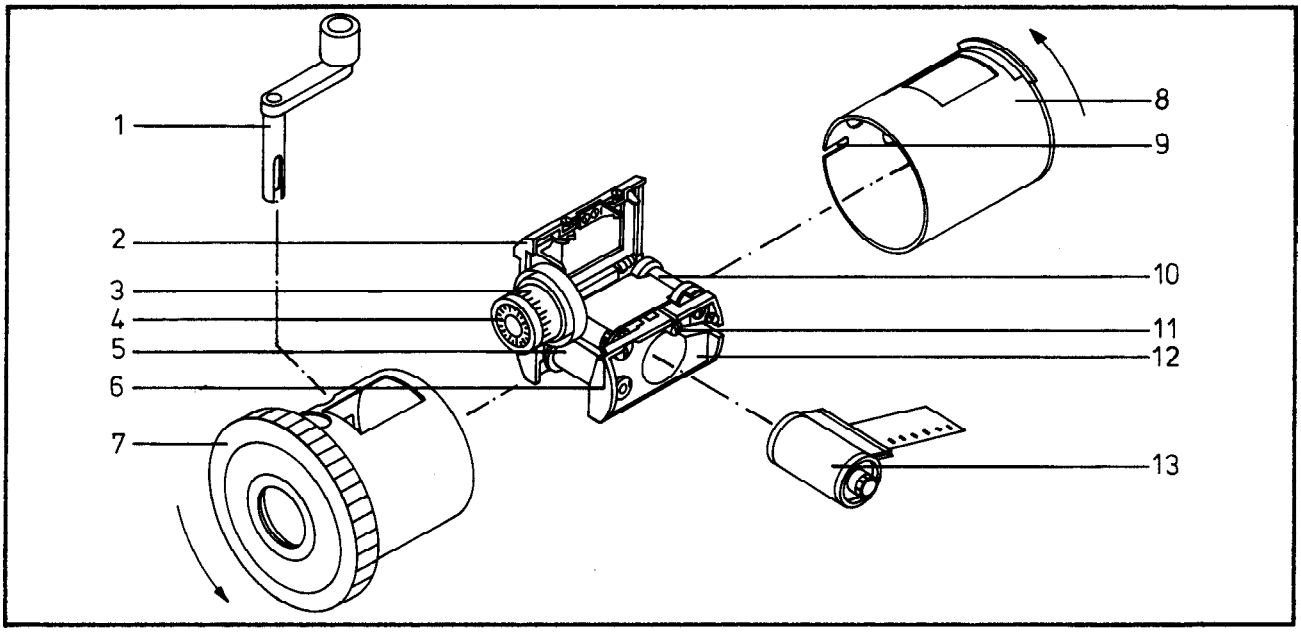
Camera

Automatic photography

Loading the cassette with a film cartridge

- Turn the cassette fully counterclockwise (it is provided with a red mark for re-fitting) and remove it from the housing.
- Press on the cassette bottom, turn upper part (7) clockwise and pull out inner housing (8).
- Remove spool holder (12) from inner housing (8).
- Lid (2) opens when pushing slotted knob (11).
- Load cartridge (13), pull film (emulsion up) over spool (10) so that the sprockets of transport spool (6) engage the film perforation.
- Thread film behind spool (5) and fix it in the usual manner. Tighten film by turning spool (5). Close lid and let it snap in.
- Put spool holder into inner housing (8); the pin of the spool holder must engage notch (9).
- Assemble cassette, close it by a counterclockwise turn, fit it in the microscope (red mark) and lock it by a clockwise turn.
- Set dial (4) to the film type used. Make two blind shots (e.g. with pushbutton B) and set frame counter (3) of cassette to 35.
- Set speed selector to the film speed.
- The exposed film is rewound with crank (1).

30



Fitting the cassette and negative identification

Attach cassette to housing —red line opposite red dot — push it in and secure it by a clockwise turn.

Every film advance is recorded by the cassette (1) (47 20 26-9901) with frame counter. It stops the automatic system if no film is loaded, the film is torn or the end of the film reached.

Cassette (2) (47 20 27-9901) for negative identification has no frame counter. Film advance is stopped only when the end of the film is reached.

The supplied foils are coated on one side, and two small holes limit the 4 mm wide margin for identification data. Entries made with pencil can be erased any number of times.

The lettered foil is slid under the spring clip of slider (3); the latter is slid into the slot of the cassette as far as it will go.

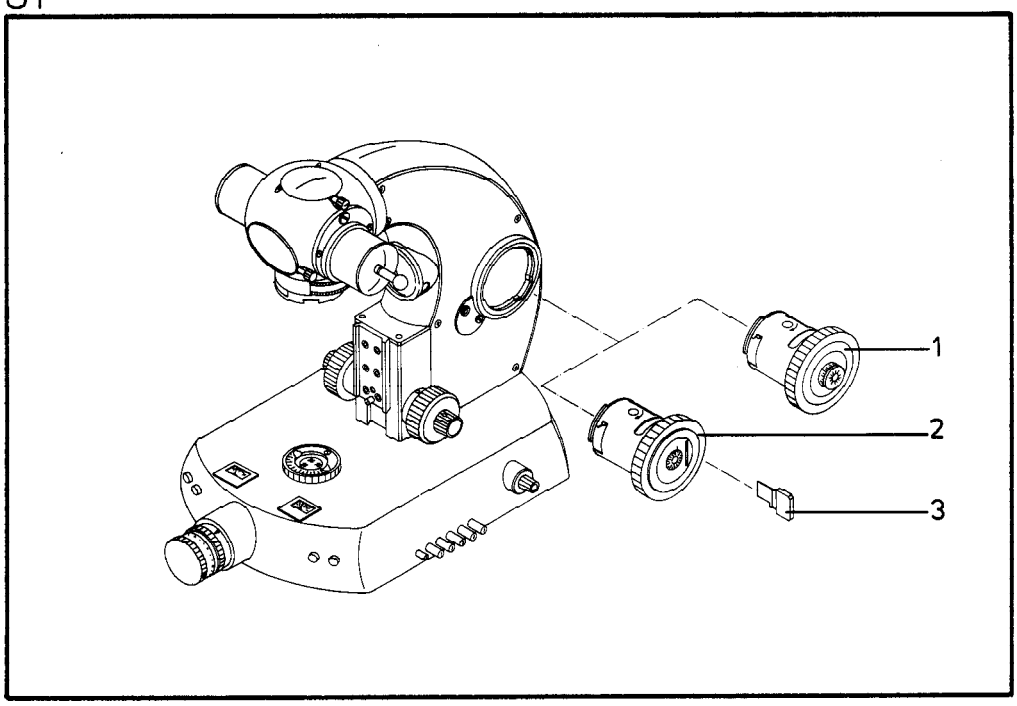
Foils with image scales (47 20 92) feature L-shaped recesses where objective magnification (e.g. 40) and Optovar position (e.g. 1.25) are indicated. A scale bar (e.g. 50 μm = 0.05 mm) can be superimposed onto the image.

Using, for example, epi-condenser II C for wide field with the factor 0.63, the Optovar is operative in position

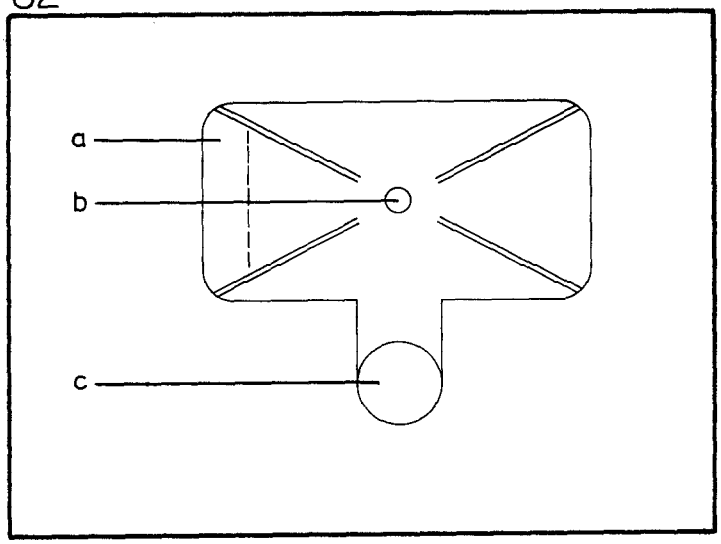
	1.25	1.6	2
with the factor	0.8	1	1.6

When cassette (47 20 27-9901) with negative identification is loaded with a film, slider (3) with or without foil must be inserted in the slot of the cassette.

31

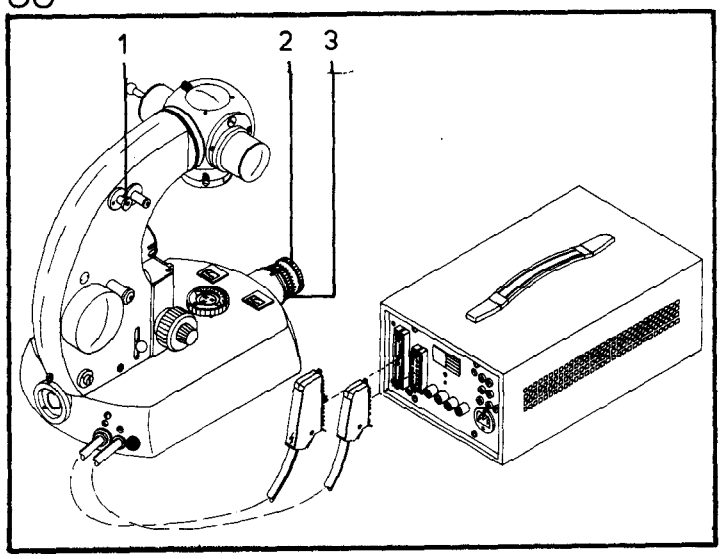


32



a negative identification area
b spot measurement of automatic system
c the light sensor of the computer flash determines the flash duration according to the brightness of this area

33



Adjust the specimen image in the tube as described on p. 14 ff for brightfield.
Pull the pushrod of the reflecting system as far as the black ring. The image section that will be photographed is visible through the tube. The picture will be sharp only if both the double lines and the image in their direct vicinity will be in focus. Focusing is particularly important at low magnifications. Like in the camera viewfinder, the image section that can be seen when the reflecting system is in position for photography is smaller than on the film. To avoid vignetting the luminous field diaphragm should be opened further.

Leave knob (1) pushed for integrated measurement. The automatic system then determines the exposure time according to the mean brightness of 2/3 of the image field center. (For spot measurement see p. 29). The light sensor of the automatic exposure control is an HTV 931 A photomultiplier which is insensitive to red light.
Film material with speeds from 5 DIN (2.5 ASA) to 40 DIN (8000 ASA) can be used.

With selector (2) and correction switch (3) set automatic exposure control to film speed and developer so that the shutter is closed after the correct exposure time.
For black-and-white photography set the film speed indicated by the manufacturer of the film.

For automatic photography on color reversal film the film manufacturer usually recommends test exposures before starting a film series. 3 DIN intervals and/or changes of ASA values by a factor of 2 can be set with the film speed selector. Each step towards higher values shortens the exposure time by one half.
With the film speed correction switch intervals of ± 1 DIN or changes of ASA values by a factor of 1.26 are possible.
For filters and lamp voltages see pp. 12/13.

The measuring instrument to the right on the microscope base is the brightness indicator for photography. It deflects in the case of short exposure times. No deflection indicates exposure times of 1 sec or longer. Full deflection which corresponds to an exposure time of less than 1/100 sec, stops the automatic exposure control. The intensity of the illumination must then be reduced by varying the lamp voltage (for black-and-white film only) or by the use of light filters, or a lower-speed film must be used, or flash exposures made.

Test exposures with the automatic exposure control

Starting from the given film speed (e.g. 18 DIN/50 ASA) make three test exposures at two times longer exposure times and two at two times shorter ones.

Example

DIN	9	12	15	18	21	24
ASA	6.3	12.5	25	50	100	200

For photography use that position of the film speed selector which brought about the best picture.

Pushbutton A which is pushed when the reflecting system is in photography position, opens the camera shutter and releases automatic operation. It closes the shutter again after the correct exposure time. The film is advanced and the camera ready for the next exposure.
Pushbutton A lights as long as the shutter is open.
When the automatic exposure control is released, e.g. by pushing button A, the measuring instrument to the right on the microscope base **indicates the exposure time**. The time the pointer needs to reach its starting position is a measure of the exposure time.

Pushbutton ! lights when the camera is ready for exposure, it **flashes** if no film is loaded, the film is torn, or the end of the film reached.

Push this button to advance the film by one frame without exposure, or to release the locked automatic exposure control or film advance.

Brief instructions for photography with automatic exposure control

The microscope is ON

- The image is adjusted in the tube
- The reflecting system is in photography position and the eyepieces are focused on the double-line cross
- The cassette with loaded film is inserted
- The upper left knob on the Photomicroscope is pushed in (integrated measurement)
- Pull the pushrod of the reflecting system as far as the black ring
- Focus the image with the fine focusing control
- Check correct film speed setting
- Push button A. The noise of the film advance indicates that the camera is ready for the next exposure.

Microscope magnification and image scale

The microscope magnification when viewing the image through the tube is determined by multiplication:

$$M = M_{obj} \times T \times M_{eyep}$$

where
M = microscope magnifiaction
M_{obj} = objective magnification
T = tube factor
M_{eyep} = eyepiece magnification

Tube factor T can be set to 1.25 – 1.6 and 2.0 with the Optovar.

Metallographic standard magnifications

Standard magnification = M_{obj} x tube factor (for epi-condensers II C, III C, III D) x M_{eyep}

50	4	1.25	10
100	8	1.25	10
200	16	1.25	10
500	40	1.25	10
1000	80	1.25	10

For epi-condensers see p. 36.

Image scale

This is the ratio of a distance on the film to its true length. The image scale of the integral camera of the Photomicroscope is the product of:

$$M_{obj} \times T \times \text{factor of projection lens } 3.2$$

Image scale on film with condensers II C, III C and III D

Objective	Optovar set to		
	1.25	1.6	2
4	16	20	25
8	32	40	50
16	63	80	100
40	160	200	250
80	320	400	500

Image scale on film with condenser III C for wide field (factor 0.63)

Objective	Optovar set to		
	1.25	1.6	2
4	10	12.5	16
8	20	25	32
16	40	50	63
40	100	125	160
80	200	250	320

With MC 63 attachment camera the image scale on film of large-format cameras is:

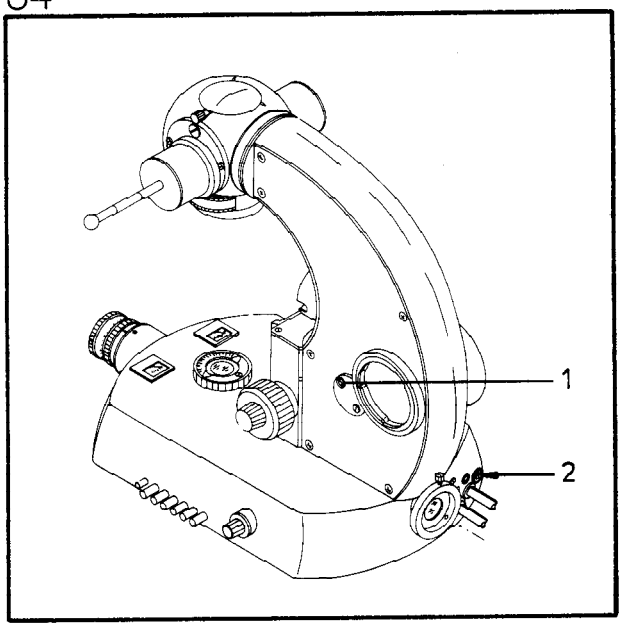
$$M_{obj} \times T \times M_{eyep} \times 0.8$$

(see also operating instructions G 41-415).

To ensure exactness of your work, calibrate once every optical combination with a stage micrometer.

Special applications

34



Multiple exposure (1)

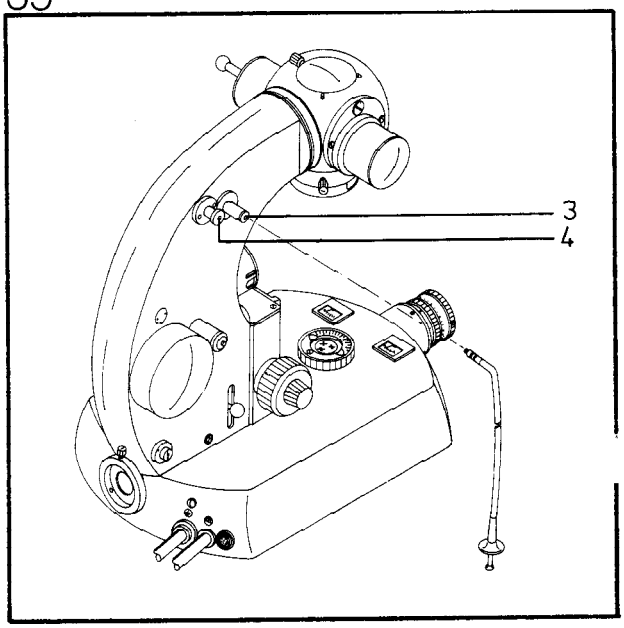
As long as pin (1) is pushed down, e.g. with a screwdriver, multiple exposures are possible. The film advance is blocked. The film advance motor works as usual but its connection to the cassette is interrupted.

If the exposure time is known (e.g. previously determined as switching time of the automatic system):
Pushbutton B opens the shutter electrically; when released it closes the shutter.
Pushbutton T opens the shutter and closes it when pushed again and at the same time unlocked.

Remote control (2)

Like with pushbutton A the automatic exposure control can be released by a remote control, a pedal switch or a pulse generator which is plugged in at the back of the microscope base (arrow) between sockets 1 and 2.

35



Dull images (3)

To expose images of low light intensity connect a cable release at (3). When pushed the automatic system opens the shutter as if pushbutton A were operated. As long as the cable release is pushed all light is directed on the film, i.e. two times the energy and half the exposure time, but during this time the specimen cannot be observed. Observation is possible when releasing the cable release; to speed up exposure push it again. Like the supplied one the cable release should protrude at least 17 mm.

Spot measurement (4)

Pull this knob for spot measurement with the automatic system. The exposure time is then measured according to the intensity of the illumination within the circle in the center of the reticle. Use this kind of measurement if the contrast is extreme and small areas of the specimen are important for image content and exposure.

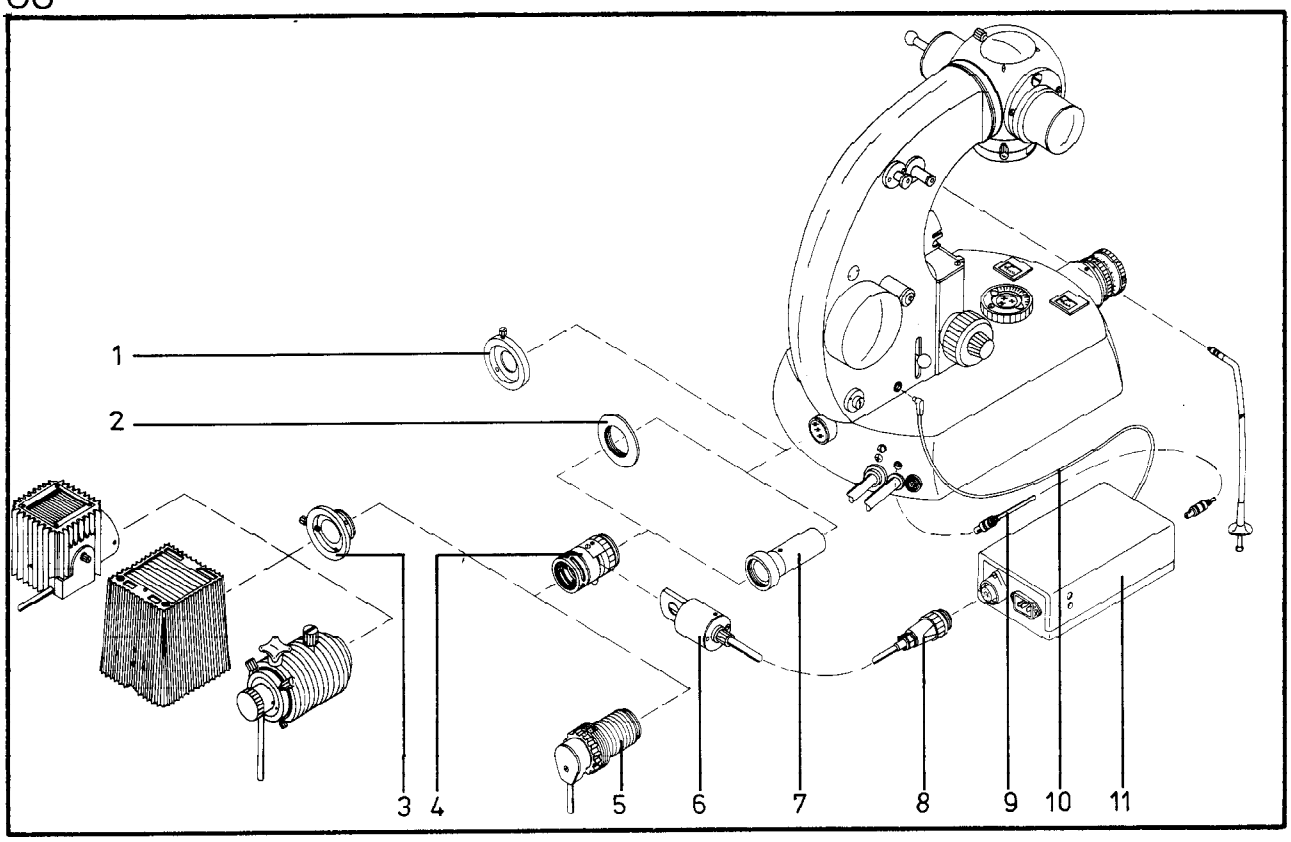
Computer flash

The built-in light sensor measures the image brightness in the film plane and automatically determines the flash duration between 1/50 000 and 1/500 sec. Xenon flash is excellent for true color reproduction on daylight color film. Films with speeds between ca. 6 and 27 DIN can be used.

Assembly

- If the microscope is equipped with tube (46 70 40-9903) for illuminator 100, exchange dovetail receptacle (1) for ring (2) (47 70 09).
- If the microscope is equipped with tube (46 70 50), exchange this tube for tube (7) (46 70 45) (proceed with the assembly as described on p. 8).
- Insert flash slider with cable (6, 8) (46 80 46) in flash double lamp condenser (4) (46 70 20) and secure with screw.
- Plug cable to microflash II (11). Screw double flash lamp condenser (4) to lamp housing with lamp condenser (5) (46 72 50). (Via adapter (3) (46 70 42) illuminators 30, 60 and 100 can be attached instead of the aforementioned lamp housing).
- Equip lamp housing with illuminators and make electrical connections (see also p. 34).
- Secure flash unit by tightening clamping ring towards the microscope, which determines the lateral tilting position of the illuminator.
- Plug flash cable (0.5 m) (10) (38 00 74-4840) to sockets of flash generator and Photomicroscope. Plug sensor cable (9) (39 79 02-8003) to sockets of flash generator and Photomicroscope.
- Connect flash generator to the mains; the power switches of microscope and flash generator must be OFF.

36



Flash generator (39 29 03-9901)

1 Power switch: position 0 OFF
position 1 ON

2 Pushbutton for flash release, e.g. for test release

3 Step switch to change the speed in 4 steps

4 Signal lamp lights if the exposure is sufficient after flash discharge

5 Socket for flash cable

6 Signal lamp lights when the flash generator is ready

7 Socket for light sensor of Photomicroscope

8 Socket for flash slider cable

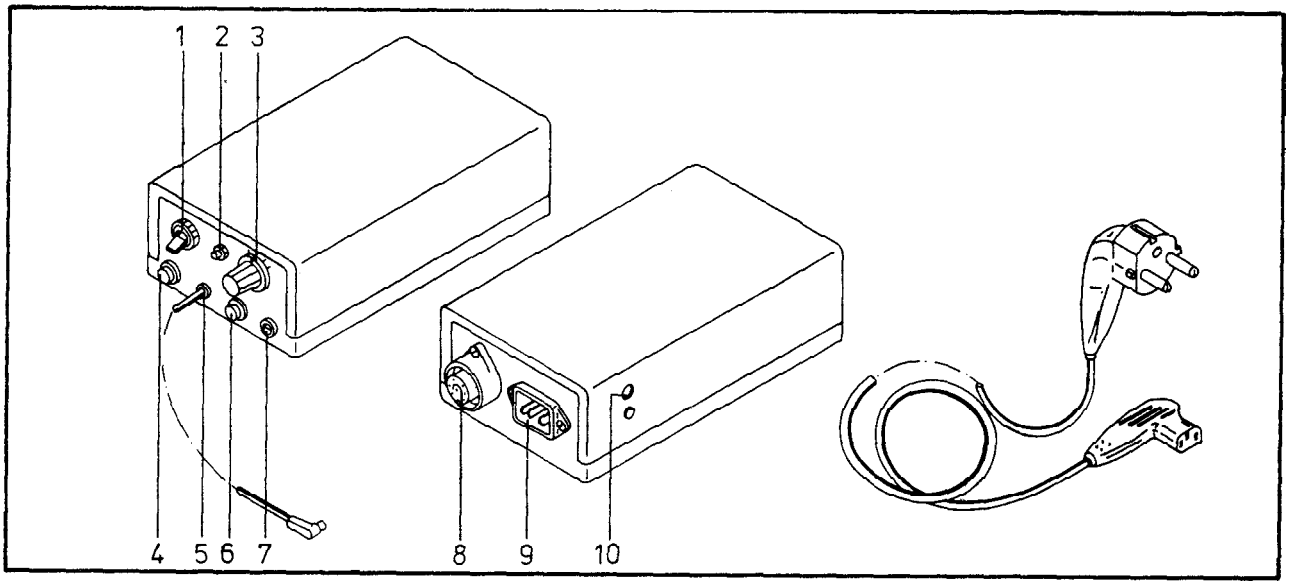
9 Mains socket

10 Voltage indicator

Technical data

Mains voltage	100-110-115-127-220-240 V
Frequency	50 ... 60 Hz
Power consumption	12 VA
Output	45 Ws
Max. flash frequency	12 ... 15 sec
Fusing	fuse switching off the mains voltage in case of high temperatures and on again at normal temperature
Note	to avoid overheating the instrument, interrupt ca. 3 min after ca. 50 flash releases

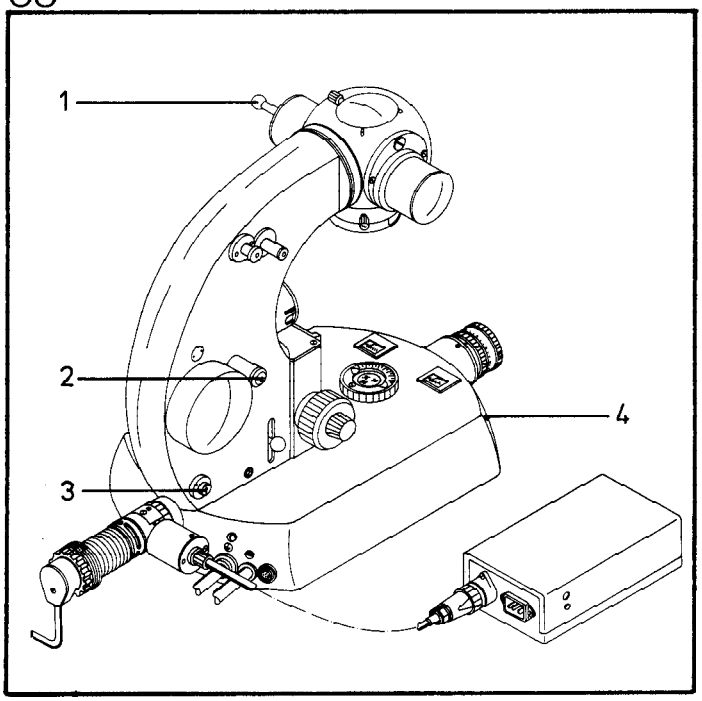
37



Exposure

Special note: For a better control by the computer flash put a neutral density filter 0.12 into the filter holder of the epi-condenser in brightfield and with objectives of 10x and lower magnifications. Use no filter when working with objectives of higher than 10x magnification. When applying light-attenuating methods such as DIC work without neutral density filter also with objectives of lower than 10x magnification.

38



- A film is loaded in the cassette.
- Pushrod (1) is set to black ring for photography. Make sure that no extremely bright or dark feature lies at the site of measurement of the light sensor (2) of the computer flash. The light sensor measures within the circular area below the outlines of the photographic format.
- Power switch of flash generator ON.
- Push stand-by button (3).
- Pushing button B (4) shortly opens the shutter and at the same time fires the flash via flash terminal. Push stand-by button (3) again if you want to use the normal automatic exposure control of the Photomicroscope.

Calibration

Light sensor (2) is adjustable with a coin to different speeds, synchronous with the speed switch of the flash generator. For an exact adjustment make a series of test exposures.

Switch positions for exact calibration

Film speed	DIN	6	9	12	15	18	21	24	27
	ASA	3	6	12	25	50	100	200	400
Position of light sensor of **Photomicroscope III**	1					1	2	3	4
	2				1	2	3	4	
	3			1	2	3	4		
	4		1	2	3	4			
	5	1	2	3	4				
		Switch position of flash generator							

As a rule, set the Photomicroscope's light sensor to 1 or 2 for a speed range between 18 and 27 DIN and/or 15 and 24 DIN.

Important note
Because the maximum flash duration is limited, do not use low-speed films at high magnifications and/or in DIC. Because of their high resolving power it is useless to apply low-speed films in photomicrography, where not the film material but the optical system of the microscope limits the resolving power.

Please note that if the green lamp Control of the flash generator lights after flash discharge, there was enough light for correct exposure. If this lamp does not light, the limit of capacity of the flash is reached or has been exceeded. Lower magnification, no light-attenuating filters or higher-speed film will then ensure correct exposure.
The capacity of the flash can be expanded by the use of a cable release (top left of the microscope). You then cannot observe the specimen during exposure, but double the amount of light will reach the film.

Components and accessories

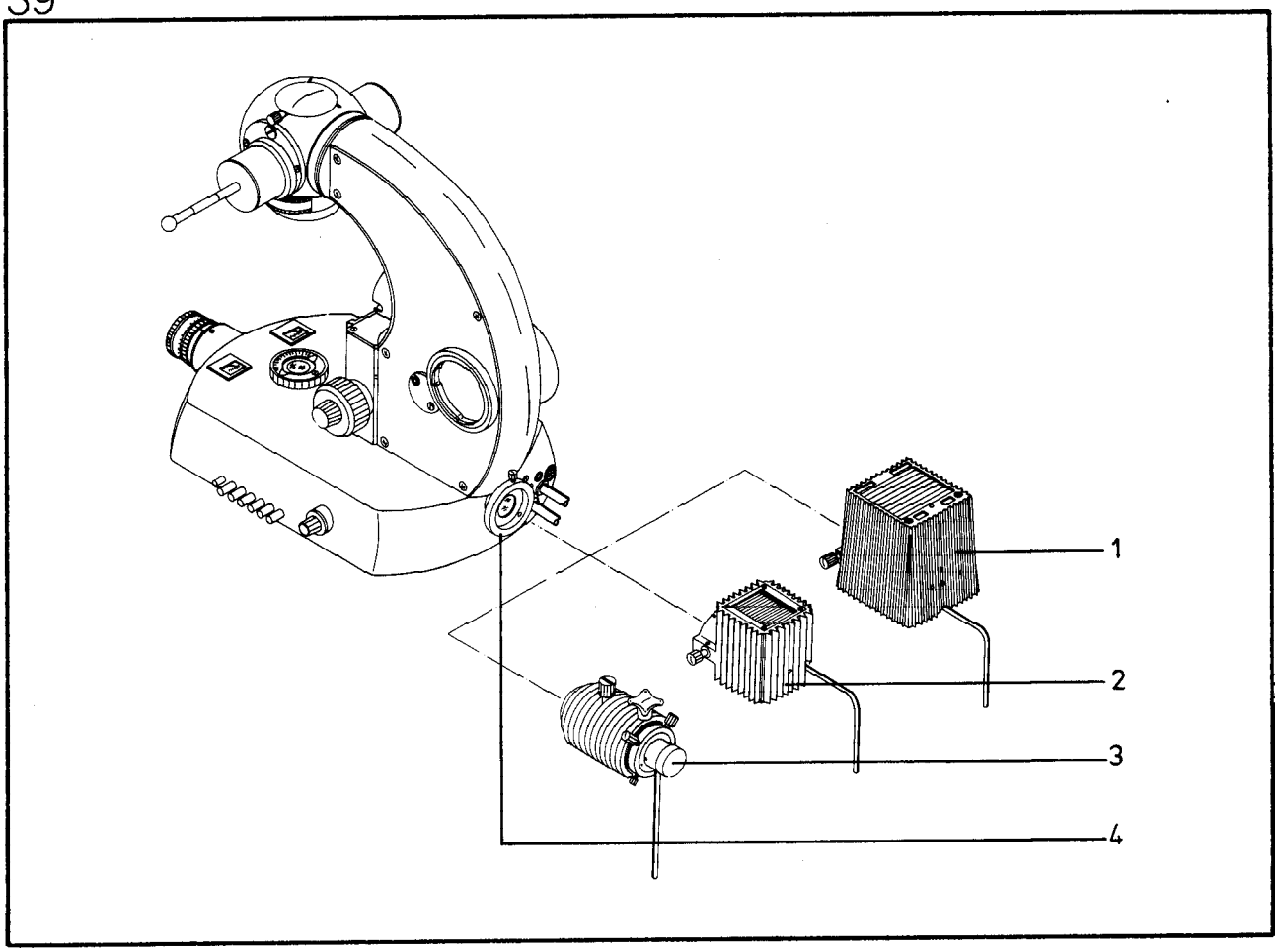
Microscope illuminators

1 illuminator 100
2 illuminators 30
3 illuminators 60

} are mounted on tube (4) (46 70 40-9903)

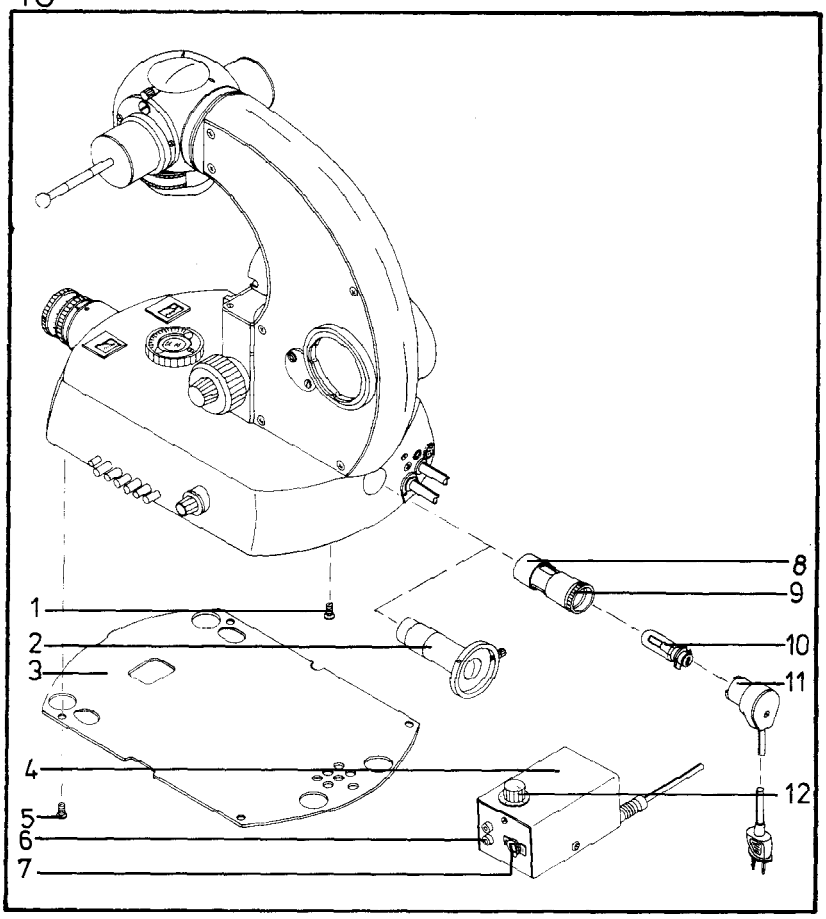
Because assembly, lamp exchange and adjustment of illuminators 30, 60 and 100 are described in the corresponding operating instructions, only the 6 V 15 W low-voltage illuminator is dealt with in this manual.

39



6 V 15 W illuminator

40



Tube with lamp condenser (8)	46 70 50
6 V 15 W low-voltage filament lamp (10)	38 00 18-1740
Socket (11) of 6 V 15 W lamp	46 80 10-9903
6 V 15 W step-up transformer (4)	39 25 64-9903

Two lamp cable sockets (6); connect only a 6 V 15 W lamp

ON-OFF switch (7)

Step switch (12) to vary the lamp voltage in steps of 1 V

Assembly

Exchange tube (2) for connection of illuminator 100 for tube (8):
loosen four screws (5), remove plate (3), loosen screw (1), pull out (2), insert (8) and secure it.
Hold filament lamp (10) with a soft cloth, plug it into socket (11) (red dot opposite red pin). Push lamp in, turn it clockwise to the stop and let it snap in. Remove fingerprints on the bulb. Turn ring (9) until its red dot is opposite the red dot of tube (8). Slide filament lamp in socket into tube (8) and secure with ring (9).
Connect lamp cable to the mains via transformer.

Technical data of step-up transformer 39 25 64-9903

Primary voltage	110-127-220-240 V
Frequency	50 ... 60 Hz
Power consumption	25 VA
Secondary voltage	3-4-5-6-7-8 V

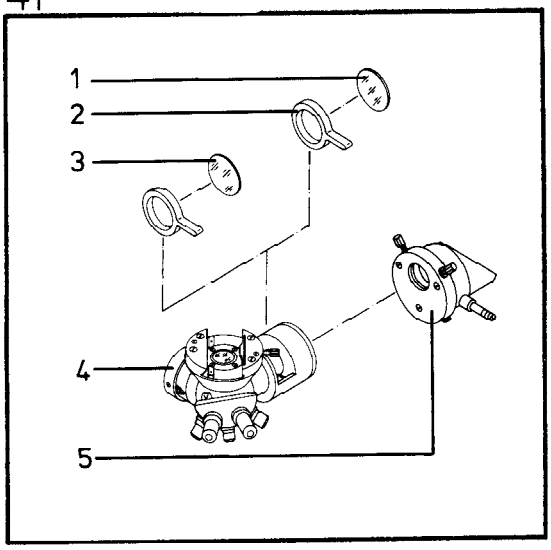
Fusing acc. to DIN 41662

F 1	100 ... 127 V	T 0.315 A	250 V	38 01 27 0150 000
	220 ... 240 V	T 0.16 A	250 V	38 01 27 0120 000
F 2		T 3.15 A	250 V	38 01 27 0260 000

Epi-condensers

Epi-condenser III D

41

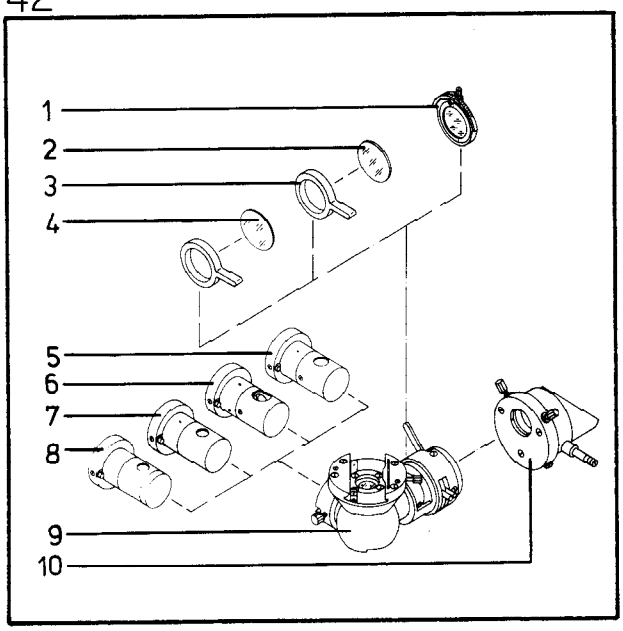


It is equipped with Epiplan objectives 4/0.1-8/0.2–16/0.35-40/0.85-80/0.95, which are rigidly mounted. The metallographic standard magnifications with Kpl 10x eyepiece are engraved on the edge of the nosepiece and can be read off at an index line. The H-Pl reflector is non-exchangeable, the fixed luminous field diaphragm is always centered and adjusted to a field-of-view number of 18.

	Epi-condenser III D, comprising:	Cat. No.
1	Clear blue glass 32x1.2	46 78 35
2	Holding ring for light filter (2x)	46 72 52
3	Neutral density filter NG 9, 32x1	46 78 26
4	Quintuple nosepiece with plane-glass reflector/brightfield and rigidly mounted objectives Epiplan 4/0.10 Epiplan 8/0.20 Epiplan 16/0.35 Epiplan 40/0.85 Epiplan 80/0.95	46 62 47-9902
5	Aperture diaphragm for epi-condensers	47 20 75
	Epi-condenser III D, complete	48 63 78

Epi-condenser II C

42

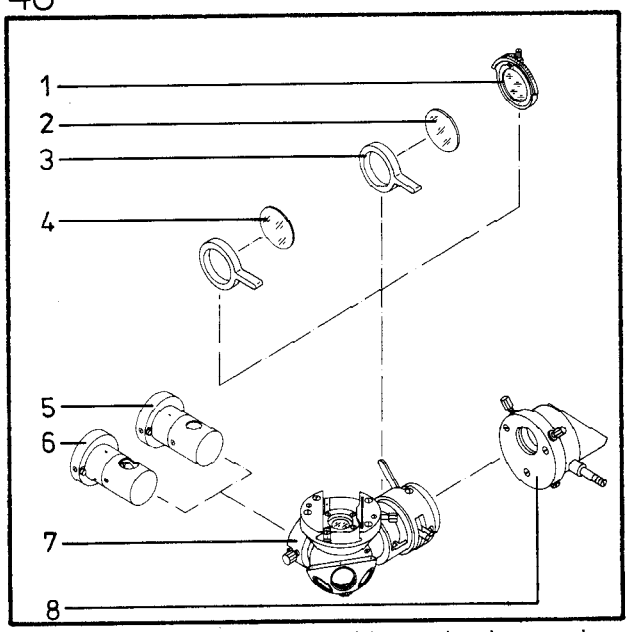


Depending on the fitted reflectors and objectives, the condenser can be used in brightfield, darkfield, DIC, polarizing (ore) microscopy and for the Antiflex method. It is equipped with a quick changer for single objectives and a variable, centerable luminous field diaphragm.

Epi-condenser II C	brightfield and darkfield	ore microscopy	Cat. No.
1 Polarizer for epi-condenser		x	47 36 16
2 Clear blue glass 32x1.2	x	x	46 78 35
3 Neutral density filter NG 9, 32x1	x	x	46 78 26
4 Holding ring for light filters (2)	x	x	46 72 52
5 H-Pl reflector	x	x	46 62 60-9903
6 H-Pl Pol reflector (Vickers licence)		x	46 62 65
7 H-Pr Pol reflector		x	46 62 61
8 Reflector D	x		46 62 62-9903
9 Epi-condenser II C	x	x	46 62 37-9902
10 Aperture diaphragm for epi-condenser	x	x	47 20 75
	48 63 67	48 64 68	

Epi-condenser III C

43



Epi-condenser III C is available in the following three models:

- for normal object field, 33 mm parfocal length (48 63 61)
- for normal object field, 45 mm parfocal length (III C/45) (48 62 50), especially suitable for DIC, and bearing the engraved parfocal length 45 and the condenser factor 1.1.
- for wide-field observation (48 63 62); object field enlarged by 240 %, engraved with condenser factor 0.63.

The condenser with exchangeable quadruple nosepiece and exchangeable reflector and with variable and centerable luminous field diaphragm can be used in brightfield, darkfield and DIC, and for the Antiflex method.

Epi-condenser III C	III C for brightfield/ darkfield	III C/45 for brightfield darkfield and DIC	III C wide field for brightfield/ darkfield	Cat. No.
1 Polarizer for epi-condenser		x		47 36 16
2 Clear blue glass 32x1.2	x	x	x	46 78 35
3 Holding ring for light filters (2x)	x	x	x	46 72 52
4 Neutral density filter NG 9, 32x1	x	x	x	46 78 26
5 H-PI reflector	x	x	x	46 62 60-9903
6 Reflector D	x	x	x	46 62 62-9903
7 Epi-condenser III C/45 with quadruple nose-piece		x		46 62 44-9901
Epi-condenser III C for wide field with quadruple nosepiece			x	46 62 45
Epi-condenser III C with quadruple nosepiece	x			46 62 46
8 Aperture diaphragm for epi-condenser	x	x	x	47 20 75
	48 63 61	48 62 50	48 63 62	

Reflectors

General information

Reflectors direct horizontally incident light vertically to the specimen.
The following reflectors are available for different types of illumination:

H-PI reflector

for brightfield and DIC, Cat.No. 46 62 60-9903

H-PI Pol plane-glass reflector

(Vickers licence) for brightfield and DIC, preferably for polarizing microscopy,
Cat.No. 46 62 65

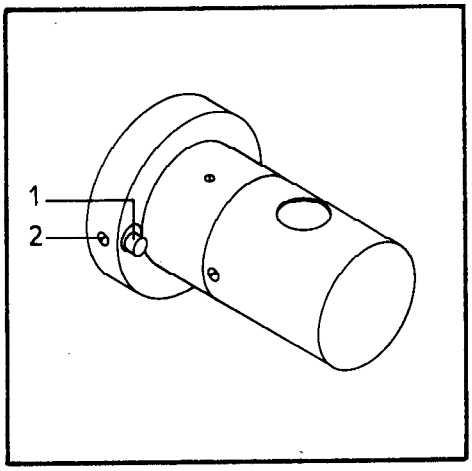
H-Pr Pol prism reflector

for brightfield, preferably for polarizing microscopy,
Cat. No. 46 62 61

Reflector D with ring mirror for darkfield illumination,

Cat. No. 46 62 62-9903

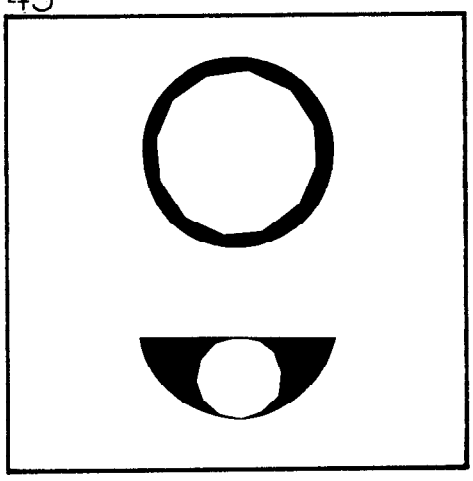
44



Adjustment

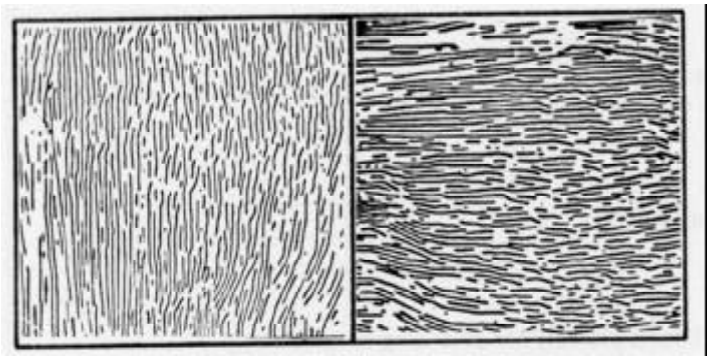
It may be necessary to precisely adjust subsequently supplied reflectors for the epi-condensers II C and III C: loosen screw (2), make the adjustment with screw (1), and tighten screw (2) again.

45



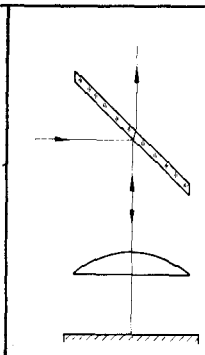
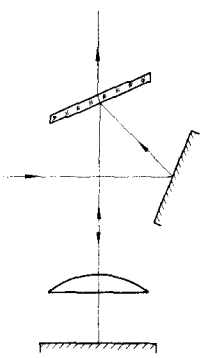
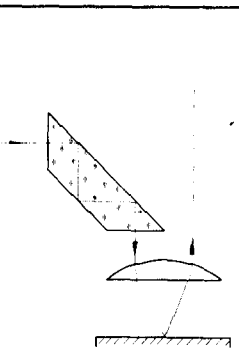
When exchanging a plane-glass reflector for a prism reflector, the position of the luminous field diaphragm image may vary only slightly, while the aperture diaphragm image must lie within the hemispherical opening.

Reflector D is correctly adjusted if it produces a circular, symmetrical light bundle on a white surface underneath with open apertures and without objective.



In illumination with reflector H-Pl structures are equally well resolved in either direction.
In illumination with reflector H-Pr Pol the resolution is 50 % reduced normal to the prism edge.

Differences, properties and applications of reflectors

			
	H-Pl reflector	H-Pl Pol reflector	H-Pr Pol reflector
Resolving power of the objective	fully utilized		normal to prism edge only 50 % utilized
Illumination aperture	up to full objective aperture		up to 50 % objective aperture
Direction of illumination	usually straight; oblique illumination possible		oblique illumination only
Image brightness	losses through beam splitting		considerably higher than with plane glass
Illumination (photomicrography)	uniform		with weakly reflecting specimens slight vignetting on top and at bottom; suitable for photomicrography only with restrictions
Polarized light	only with restrictions because of depolarization	well suitable because of minimum depolarization	
Reflections	reflections by objective lens surface and plane glass unavoidable, causing blurred images of weakly reflecting specimens; double images possible at high contrast due to reflection by plane glass back surface (can be reduced by polarizer)		virtually reflex-free images with correct illumination adjustment; suitable to measure reflectivity photometrically

Objectives

General information

Epiplan objectives produce high-contrast, perfect flatfield images of polished surfaces.
LD Epiplan objectives have particularly long working distances and can be equipped with caps for protection against heat or etching vapors.
LD Epiplan Pol objectives can be equipped with an additional crystal plate for use of the contrast-enhancing Antiflex method.

From the ample selection of objectives the tables below list besides basic series of Epiplan HD objectives only those items which can be used with DIC systems and/or caps, and the possible combinations condenser – adapter rings – DIC systems – objectives can be seen in the block diagrams on the following pages.

Brightfield/darkfield flatfield objectives

Magnification/NA	Working distance (mm)	Cat. No.
Epiplan HD 4/0.10	2.0	46 02 69-9901
Epiplan HD 8/0.20	2.0	46 03 69-9904
Epiplan HD 16/0.35	2.0	46 05 69-9906
Epiplan HD 40/0.85	0.23	46 07 69
LD Epiplan HD 40/0.60	2.0	46 20 98
Epiplan HD 80/0.95	0.09	46 08 69
Epiplan HD 100/1.25 oil	0.25	46 19 69

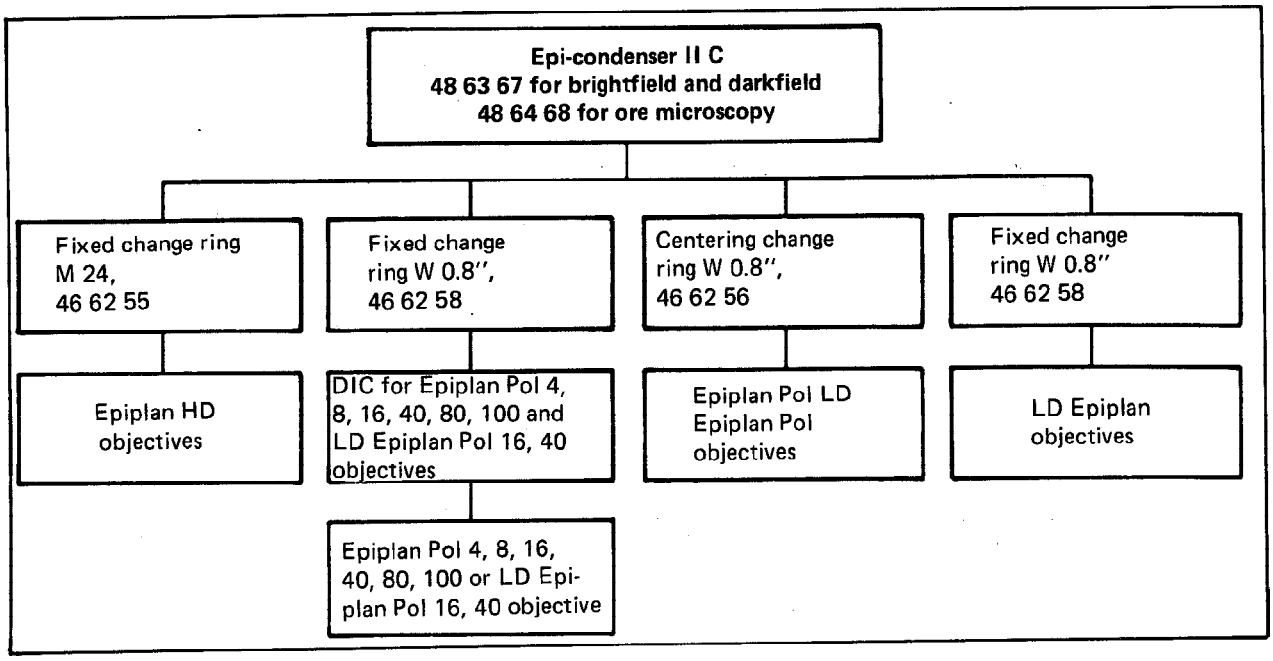
Flatfield objectives for combination with DIC systems

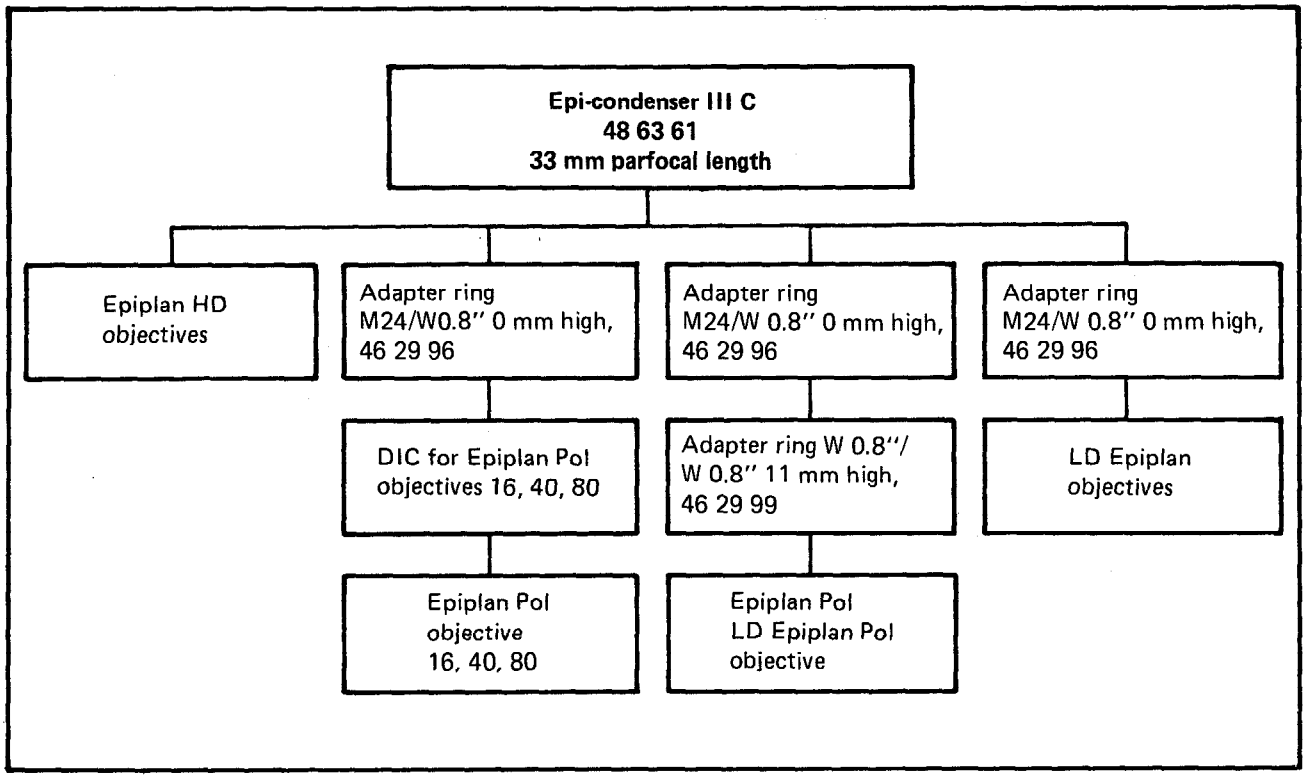
Magnification/NA	Working distance (mm)	Cat. No.	DIC system Cat.No.
Epiplan 4/0.10 Pol	9.0	46 20 01	47 44 92-9904
Epiplan 8/0.20 Pol	7.1	46 20 02	47 44 92-9904
Epiplan 16/0.35 Pol	3.1	46 20 03	47 44 93-9904
LD Epiplan 16/0.30 Pol	4.1	46 21 23	47 44 63-9902
LD Epiplan 40/0.60 Pol	3.4	46 21 24-9901	47 44 64-9902
Epiplan 40/0.85 Pol	0.23	46 20 04	47 44 94-9904
Epiplan 80/0.95 Pol	0.09	46 20 80	47 44 95-9905
Epiplan 100/1.25 Pol oil	0.25	46 20 05-9903	47 44 96-9904

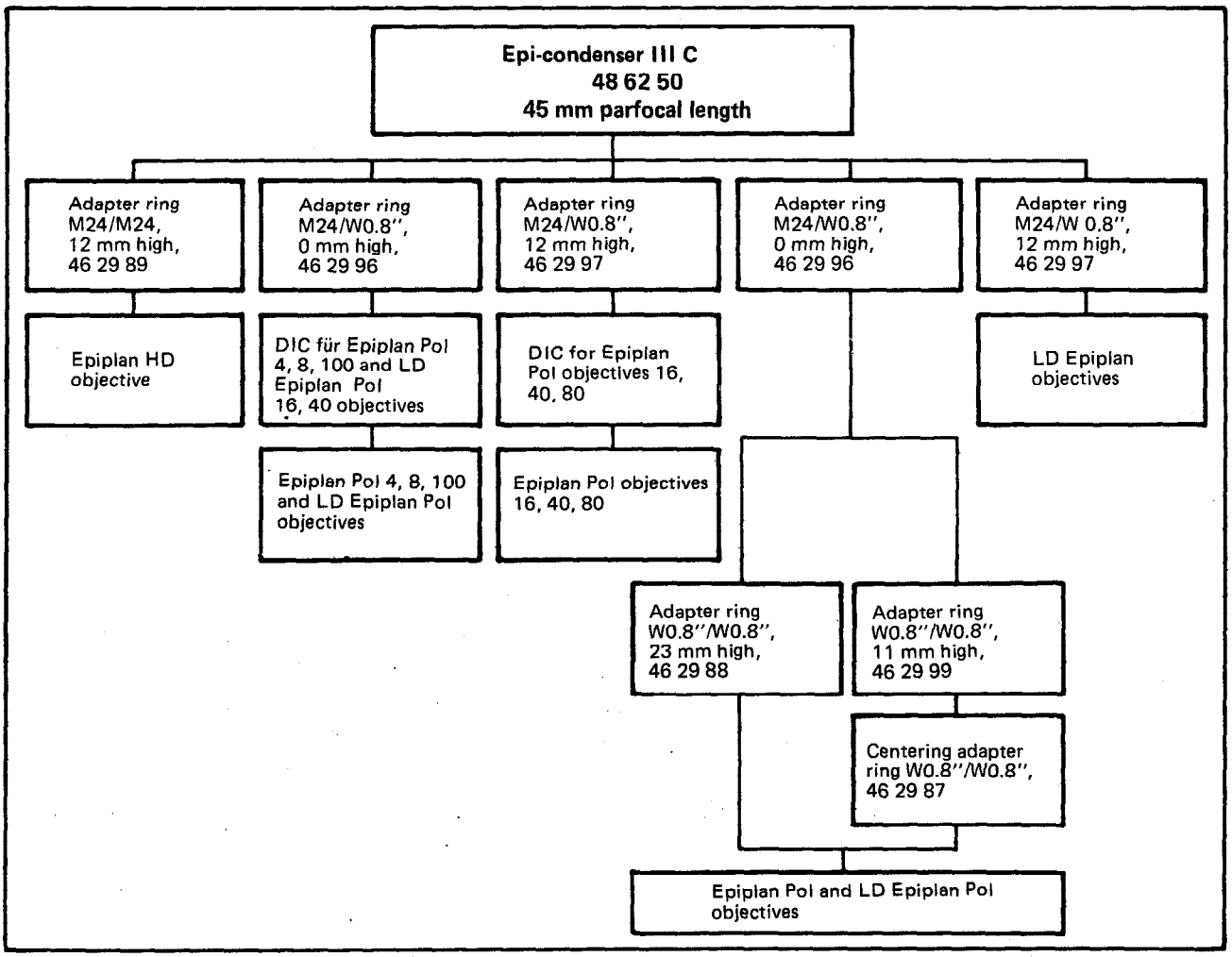
Flatfield brightfield objectives with caps for long working distances

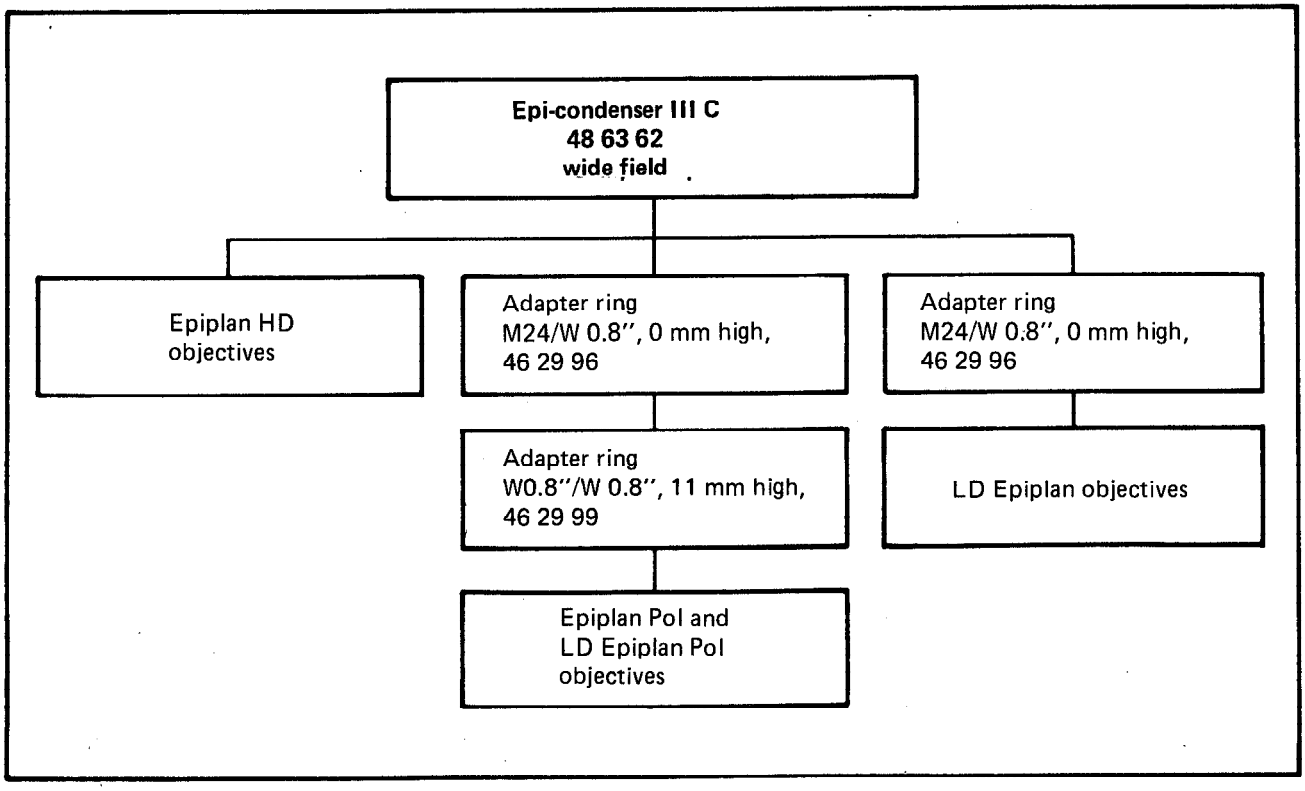
Magnification/NA	Working distance (mm) without cap	Cat.No.	Cat.No. of cap	Working distance (mm) with cap	Required coverglass thickness D with cap
LD Epiplan 4/0.10 covergl. thickn. 1.5	8.0	46 21 01	46 29 11	7.5	D = 0
LD Epiplan 8/0.20	6.2	46 21 02	46 29 12	5.7	D = 0
LD Epiplan 16/0.30 covergl. thickn. 1.5	4.1	46 21 03	46 29 13	3.6	D = 0
LD Epiplan 16/0.30 Pol covergl. thickn. 1.5	4.1	46 21 23	46 29 15 46 28 51	3.5 4.5	D = 0 D = 1
LD Epiplan 40/0.60 covergl. thickn. 1.5	3.4	46 21 04	46 29 14 46 28 52	2.3 3.2	D = 0 D = 1
LD Epiplan 40/0.60 Pol covergl. thickn. 1.5	3.4	46 21 24-9901	46 29 16	2.4	D = 0

LD Epiplan objectives with cap without optical system engraved D = 1.5 are parfocalized with a 1.5 mm thick compensating plate, e.g. of a heating stage.
If LD Epiplan objectives are used for uncovered specimens, this cap is unscrewed and exchanged for a cap engraved D = 0 with a 1.5 mm thick compensating plate.
For use of LD Epiplan objectives as condenser in transmitted light in micro-photometry, the cap engraved D = 1.5 is exchanged for a cap engraved D = 1 (0.5 mm thick compensating plate).


Epi-condenser II C
48 63 67 for brightfield and darkfield
48 64 68 for ore microscopy
Fixed change ring M 24, 46 62 55
Fixed change ring W 0.8", 46 62 58
Centering change ring W 0.8", 46 62 56
Fixed change ring W 0.8" 46 62 58
Epiplan HD objectives
DIC for Epiplan Pol 4, 8, 16, 40, 80, 100 and LD Epiplan Pol 16, 40 objectives
Epiplan Pol LD Epiplan Pol objectives
LD Epiplan objectives
Epiplan Pol 4, 8, 16, 40, 80, 100 or LD Epiplan Pol 16, 40 objective


Epi-condenser III C
48 63 61
33 mm parfocal length
Epiplan HD objectives
Adapter ring M24/W0.8" 0 mm high, 46 29 96
Adapter ring M24/W 0.8" 0 mm high, 46 29 96
Adapter ring M24/W 0.8" 0 mm high, 46 29 96
DIC for Epiplan Pol objectives 16, 40, 80
Adapter ring W 0.8"/ W 0.8" 11 mm high, 46 29 99
LD Epiplan objectives
Epiplan Pol objective 16, 40, 80
Epiplan Pol LD Epiplan Pol objective


Epi-condenser III C
48 62 50
45 mm parfocal length
Adapter ring M24/M24, 12 mm high, 46 29 89
Adapter ring M24/W0.8", 0 mm high, 46 29 96
Adapter ring M24/W0.8", 12 mm high, 46 29 97
Adapter ring M24/W0.8", 0 mm high, 46 29 96
Adapter ring M24/W 0.8", 12 mm high, 46 29 97
Epiplan HD objective
DIC für Epiplan Pol 4, 8, 100 and LD Epiplan Pol 16, 40 objectives
DIC for Epiplan Pol objectives 16, 40, 80
LD Epiplan objectives
Epiplan Pol 4, 8, 100 and LD Epiplan Pol objectives
Epiplan Pol objectives 16, 40, 80
Adapter ring W0.8"/W0.8", 23 mm high, 46 29 88
Adapter ring W0.8"/W0.8", 11 mm high, 46 29 99
Centering adapter ring W0.8"/W0.8", 46 29 87
Epiplan Pol and LD Epiplan Pol objectives


Epi-condenser III C
48 63 62
wide field
Epiplan HD objectives
Adapter ring M24/W 0.8", 0 mm high, 46 29 96
Adapter ring M24/W 0.8", 0 mm high, 46 29 96
Adapter ring W0.8"/W 0.8", 11 mm high, 46 29 99
LD Epiplan objectives
Epiplan Pol and LD Epiplan Pol objectives

Eyepieces

Magnification	Field of view	Angular field	Cat.No.
Compensating flatfield (Kpl), wide-angle (W) eyepieces Kpl 10x W Br	20	45°	46 40 44-9901
Kpl 16x	10	36°	46 42 20
Kpl eyepieces with focusing eyelens for reticles Kpl 10x W Br, foc.	20	45°	46 40 48
Kpl 12,5x W Br, foc.	20	53°	46 41 48
Kpl 16x, foc.	10	36°	46 42 23-9901

Eyepieces designated "Br" are high-eyepoint eyepieces for eyeglass wearers.

Specimen stages

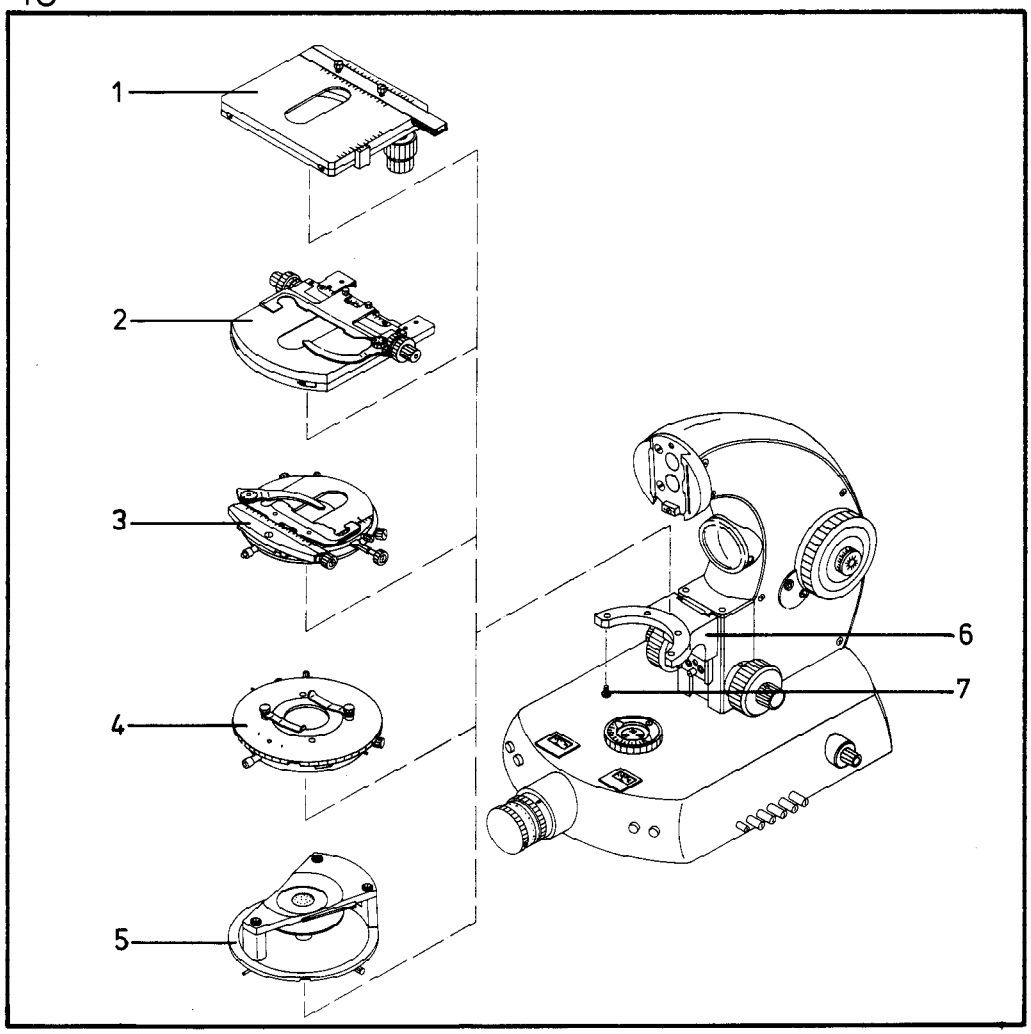
General information

Fig. 46 shows all specimen stages which can be used on Photomicroscope; the stages are described in detail further below.
The stages are mounted on the microscope by way of the attachable stage carrier (6) to which the stage is screwed with 4 screws (7). For assembly see p. 8.

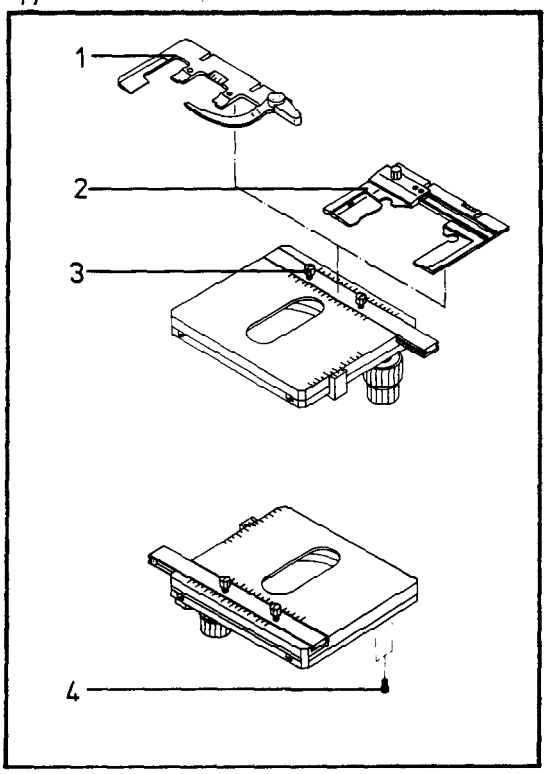
Stages and accessories

		Cat. No.
1	Mechanical stage 50x75 mm, left-hand control	47 34 15
	Mechanical stage 50x75 mm, right-hand control	47 34 16
2	Mechanical stage 50x75 mm, with graduated coaxial control on both sides	47 34 28-9901
3	Circular, rotary, centering mechanical stage 50x75 mm with centering piece, without graduation	47 34 56-9901
	Circular, rotary, centering mechanical stage 50x75 mm with centering piece, with graduation	47 34 57-9901
4	Circular, rotary, centering gliding stage with centering piece	47 34 54
5	Polished-specimen levelling stage with centering piece	47 33 19
6	Stage carrier	47 15 40

46



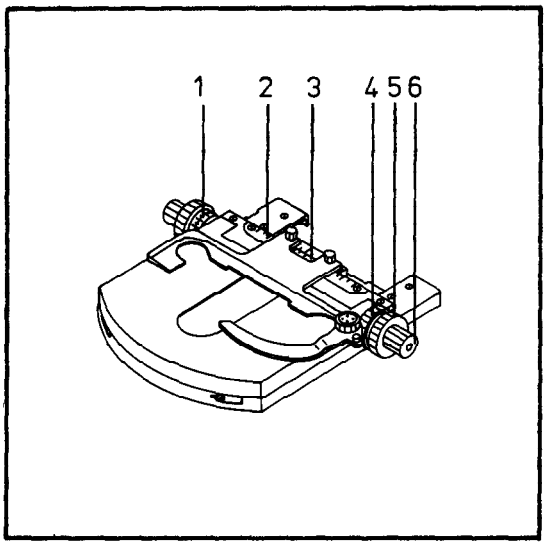
47



Mechanical stage 50x75 mm

Either specimen holder 50 (1) (47 34 48) or adjustable specimen holder (2) (47 34 45) can be fixed with screws (3). The travelling range is basically 30x75 mm, expandable to 50x75 mm by mounting the stage rotated through 180° on the stage carrier and changing the position of screw (4).

48



Mechanical stage 50x75 mm with graduated coaxial control on both sides

1 Graduation with black and red numbers corresponding to black/red graduation in reading window (2), for Y-motion.

2 Reading window for the travelling range of the Y-motion marked black and red.

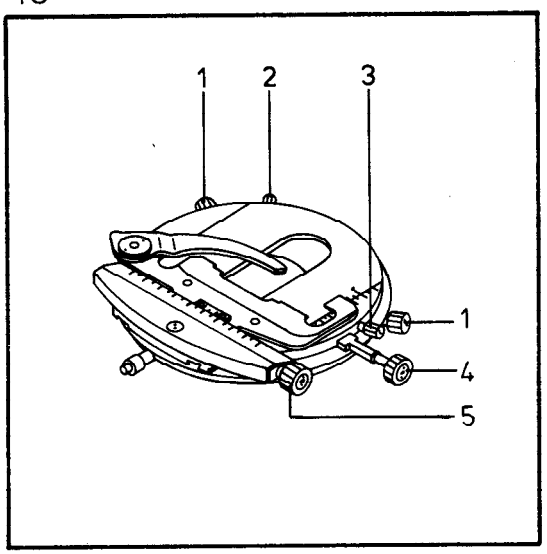
3 Graduation for X-motion.

4 Knurled ring to adjust stiffness of Y-motion control.

5 Y-motion (to-fro) control.

6 X-motion (left-right) control.

49



Circular, rotary, centering mechanical stage 50x75 mm, with centering piece, without graduation

1 Centering screws with plugged-on knobs

2 Screw to lock stage rotation

3 Screw to adjust stiffness of motion of control 4

4 Control to move the specimen in Y

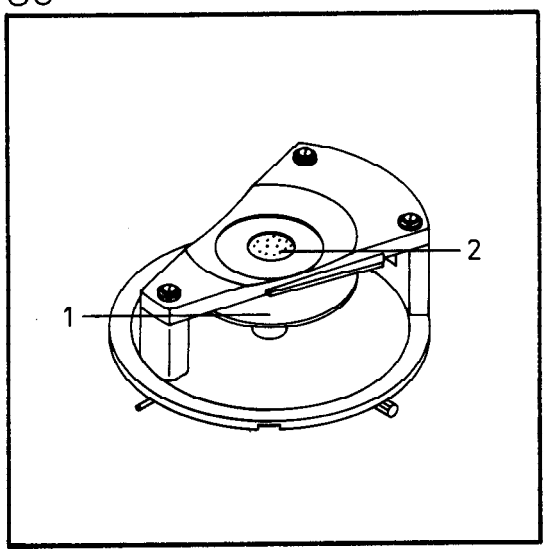
5 Control to adjust the specimen in X

Stage centering

Turn in 10x or 16x objective and focus on a fine-grain feature.
Turn specimen stage uniformly.
Turn knobs (1) on centering screws so that the center of rotation of the stage coincides with the center of the field of view. The center of rotation of the stage is that point around which all other object points rotate.
Move the specimen with centering screws (1) until it no longer moves on a circle but turns about its own axis. For exact stage centering we recommend the use of a crossline reticle in the eyepiece.

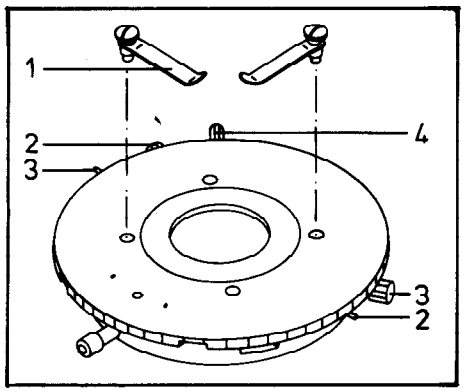
Polished-specimen levelling stage

50



A padded stamp (1) presses max. 22 mm thick polished specimens resiliently from below against (2). This aligns the specimen in the same manner as if it were placed on the stage of an invertoscope. The plastic pad compensates unevennesses at the bottom of the specimen.
The centering piece (2) adheres magnetically underneath.
The stage plate can be moved horizontally by hand 15 mm in either direction from central position. For centering and lubrication of the stage see the corresponding instructions for the gliding stage on p. 48.

51



Circular, rotary, centering gliding stage with centering piece

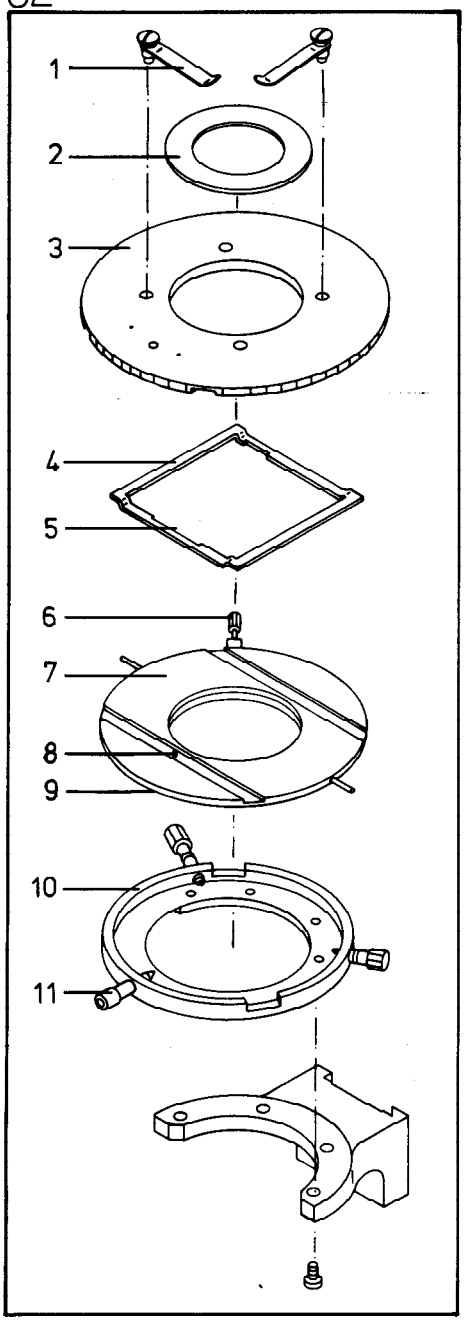
1 Stage clips (47 33 73)

2 Controls to move the stage plate; when the stage is turned the specimen remains within the field of view if the axis of rotation is centered relative to the center of the field of view.

3 Knobs on stage centering screws

4 Control to lock stage rotation

52



Gliding stage centering

Turn in 10x or 16x objective. Turn and shift gliding stage until a marked feature coincides with the axis of rotation. Mark the center of the field of view by closing the centered luminous field diaphragm.
With knobs (3) on centering screws bring axis of rotation and center of the field of view to coincidence.

Lubricating the gliding stage

When the stage has not been in use for some time the motion of its parts may be stiff, and all gliding surfaces of the stage must be lubricated with the supplied oil (10 cm^3) (46 29 78):

Remove stage clips (1), ring (2) and plate (3).

Take frame (4) out of its notches (remember for the assembly that pin 8 of the base plate must engage notch 5 of frame 4).

Unscrew centering screws (6).

Press base plate (7) against spring bolt (11) of centering piece (10) and take it out (remember for the assembly that spring bolt (11) must engage notch 9).

Clean all gliding surfaces with xylol and apply a thin film of oil.

Assemble the stage by proceeding in the reverse sequence.

Move assembled gliding stage repeatedly in all directions to distribute the oil. If the motion is too smooth, you have used too much oil.

Further equipment of Photomicroscope is described in these operating instructions:

G 41-303	Microscope illuminator 30
G 41-310/III	Microscope illuminator 100
G 41-351	Epi-fluorescence condenser III RS
G 41-415	MC 63 attachment camera system
G 41-491	Micro-Videomat 3
G 41-507	Polarizing microscopes Universal R Pol and Photomicroscope III Pol
G 41-651/I	Reflected-light microscopy, differential interference contrast
G 41-652	Multiple-beam interference equipment
G 41-657	Mirau interference equipment
G 41-710/I	MHP microhardness tester
G 41-820/I	Microscope photometer 01 K
G 41-825	Microscope photometer 03